Educational Technology Decision-Making:

A Case Study on Technology Acquisition for 746,000 Ontario Students

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Abstract

Very little research has examined K–12 educational technology decision-making in Canada. This collective case study explores the technology procurement process in Ontario's publicly funded school districts to determine if it is informed by the relevant research, grounded in best practices, and enhances student learning. Using a qualitative approach, 10 senior leaders (i.e., chief information officers, superintendents, etc.) were interviewed. A combination of open-ended and closed-ended questions were used to reveal the most important factors driving technology acquisition, research support, governance procedures, data use, and assessment and return on investment (ROI) measures utilized by school districts in their implementation of educational technology. After participants were interviewed, the data were transcribed, member checked, and then submitted to "Computer-assisted NCT analysis" (Friese, 2014) using ATLAS.ti. The findings show that senior leaders are making acquisitions that are *not* aligned with current scholarship and *not* with student learning as the focus. It was also determined that districts struggle to use data-driven decision-making to support the governance of educational technology spending. Finally, the results showed that districts do *not* have effective assessment measures in place to determine the efficacy or ROI of a purchased technology. Although data are limited to the responses of 10 senior leaders, findings represent the technology leadership for approximately 746,000 Ontario students. The study is meant to serve as an informative resource for senior leaders and presents strategic and research-validated approaches to technology procurement. Further, the study has the potential to refine technology decision-making, policies, and practices in K–12 education.

Acknowledgements

"Study the greats and become greater." – Michael Jackson (Greenburg, 2014, p. 121).

The above quote has not only been serving as my desktop background throughout the entire writing of this thesis, but it has been my inspiration ever since I began my Master of Education degree study. Over the last 2 years I have been so fortunate to learn and collaborate with some of the brightest minds I have ever met. From faculty to students, university staff to senior mentors, my success in this program comes as a direct result of your support. This has been the learning experience of a lifetime and one that has made me determined to maximize my potential as an academic researcher, educational leader, and community advocate.

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CHAPTER ONE: INTRODUCTION

"What we are experiencing today, I truly don't believe we've ever had anything quite like it. There aren't that many people who really understand the individual technologies; to manage to have them integrated is extremely complicated." – Jerry Luftman (Lebeaux, 2013, para. 6).

Over the last 30 years, the rapid advancement of emerging information and communications technologies (ICT) and their subsequent consumerization has led to an unprecedented shift in the K–12 education landscape (Bebell, O'Dwyer, Russell, & Hoffmann, 2010; Brooks, 2008; Hsu, Hung, & Ching, 2013; Jenkinson, 2009). These unique teaching and learning tools have provided school districts with the opportunity to modernize their classrooms and equip their students with critical 21st century skills (Brooks, 2008; Culp, Honey, & Mandinach, 2005; Kim et al., 2010). The Partnership for 21st Century Skills (P21; 2011) often refers to these proficiencies as the "4Cs" (p. 1) and outlines critical thinking, creativity, communication, and collaboration as essential for today's students. However, the whirlwind speed of technological development and its resulting impact on educational organizations' policies, structures, and processes has created a critical need for effective technology management and leadership (Bellamy, 2007; Morrison, Ross, Corcoran, & Reid, 2014). The responsibilities of educational leaders and policy makers are further problematized by the collective weakness of educational technology research and its inability to provide substantial empirical evidence to support technology integration as a means of improving student learning (Bebell et al., 2010; Jenkinson, 2009; Johnson & Maddux, 2008). Notwithstanding these profound challenges, publicly funded school districts have made multibillion-dollar

investments in educational technology, with spending showing no signs of slowing (Futuresource Consulting, 2014). To date, American scholarship that examines the decision-making processes of school leaders and procurement practices greatly outweighs the Canadian research, despite having districts with student populations of a similar size (Herman, 2013; Hsu et al., 2013). Accordingly, the purpose of this research is to examine the decision-making process regarding technology procurement by senior-level leaders in Ontario's publicly funded school boards. Public and private decision-makers have long been interested in a sustained inquiry into technology acquisition (Heinecke & Blasi, 2004). The key areas of investigation surrounding technology acquisition involve the formal policies and protocols that influence procurement by senior-level leaders, the academic impact of technology on student learning, and the use of data to drive decision-making.

Background to the Study

With the meteoric rise of educational technology (ed-tech) showing no signs of slowing and investments from governments and venture capital steadily increasing, there is a growing need for research that examines school district spending (Heinecke & Blasi, 2004). Despite a lull in some technology markets, the global spending on classroom technology alone (e.g., mobile devices, digital projectors, software, etc.) reached US$13 billion in 2013 and is expected to reach US$19 billion by 2018 (Futuresource Consulting, 2014). These figures do not even include the spending on information technology (IT) support needed to deploy, manage, and secure these technologies. The ed-tech sector in Canada is also looking to take advantage of this boom, as a CIBC study reports that Canadian education startup companies grew by 65% between 2007 and 2012 (Alini,

2012). Market research aside, public interest in educational technology spending may have reached a fever pitch in Ontario when the Ministry of Education announced a $150 million learning and technology fund in the fall of 2014 (to be released during the 2014–15 academic year). The news came as a surprise to many after the province had previously resisted the temptation to invest heavily into classroom technology for almost a decade (Fullan, 2013a). Minister of Education, Liz Sandals, released a statement saying:

> Students today are growing up in a world where technology and digital resources are an integral part of their everyday lives. We need to tap into that existing knowledge and familiarity with technology to make learning even more compelling, and allow our students to become the innovators, entrepreneurs and leaders of tomorrow. (Ministry of Education, Ontario, 2014)

While the news release makes mention of districts having increased funding to acquire and deploy technology to students and provide their educators with strengthened professional development, it is unclear whether districts are being advised on how *best* to spend taxpayer dollars. In fact, little provincial or national guidance is given to senior-level decision-makers in Canada despite the expectation that they quickly transform their learning environments for today's students.

The only formal guidance school boards receive related to educational technology acquisition is the Ontario Ministry of Finance's (2011) *Broader Public Sector (BPS) Procurement Directive*. The purpose of the directive, which is meant to guide *all* acquisitions made by publicly funded organizations, is to ensure accountability, transparency, and consistency throughout the BPS (Ministry of Finance, Ontario, 2011).

Though these guidelines are useful in planning, purchasing, and distribution procedures, they fail to address the specific needs of institutions in creating policy and leadership models related to educational technology. Today, Canada is still in a significant state of transition and lags behind the United States in the adoption of ICT by approximately 8–12 months (Software & Information Industry Association [SIAA], 2010). The U.S. has responded to the growing digital learning movement by creating the *Office of Educational Technology* within the Department of Education in 2006. In 2010 they released the *National Education Technology Plan* (Department of Education), an official document that outlines the goals, methods, and techniques for transforming American education through technology. By comparison, Canada and the province of Ontario lack this level of direction, instead relying on broad Ministry reports, small amounts of university-level scholarship, and surveys conducted by independent advocacy organizations (e.g., *People for Education*, *The Fraser Institute*, etc.).

Associations focused on professional learning and collaboration related to IT and ICT have been trying to address the province's need for formal direction for over 10 years in Ontario. Organizations like the Ontario Association for School Business Officials (OASBO), Ontario College Council of Chief Information Officers (OCCCIO), Ontario Software Acquisition Program Advisory Committee (OSAPAC), Educational Computing Organization of Ontario (ECOO), and so on have become leaders in fostering dialogues that support educators, administrators, and senior leaders in making decisions surrounding technology acquisition. However, it is difficult to determine if these pockets of support are adequate in helping leaders face the enormous challenges the Big Data, Open Source, and Information Privacy movements are proposing to schools. Part of the

problem is a lack of stakeholder knowledge concerning the procurement of technology. While a district's expenditures on technology are publicly available (albeit hard to differentiate between ICT, IT, and A/V or audiovisual equipment), the role of the stakeholders (i.e., parents, teachers, students, etc.) needs to be enhanced so they can trust the system is adequately addressing challenges like the ones mentioned previously (Spector, 2013).

Without government assistance and professional guidance supporting technology acquisition, frivolous spending, wasted time, and technological chaos can result. In June 2013, superintendent of Los Angeles Unified School District (LAUSD; America's second largest school district), John Deasy, announced a US$30 million commitment to provide Apple iPads for the 650,000 students in the system (the total expenditure would cost roughly US$1 billion). A myriad of problems immediately plagued the one-to-one (1:1) rollout including a rushed timeline, device hacks, poor Wi-Fi infrastructure, a lack of professional development for teachers, and intense scrutiny over the bidding procedures with both Apple and digital learning software provider, Pearson (Pickert, 2014). Simultaneously, the district and its chief information officer, Ron Chandler, began to revamp LAUSD's student information system (MiSiS) in the summer of 2014. This project was troubled as well, with inaccurate student transcripts, glitches, and lost records being reported throughout the board's 1,124 schools (Blume, 2014). By October 2014 the iPad contract had been cancelled, the MiSiS computer system had yet to be fixed, and both Deasy and Chandler had announced their resignations. The fate of the 75,000 iPads already purchased by LAUSD remains unclear.

The uninformed acquisition of technology can result in wasted funds and a loss of public trust. Therefore, the aim of this research is to determine whether the decision-making process behind technology procurement in Ontario's publicly funded school districts is grounded in relevant literature. Despite the growing interest in educational technology and its implementation throughout school districts, procurement often gets overlooked in academic research. This investigation may be the first of its kind in Canada that calls upon the viewpoints of senior-level leaders to examine their firsthand experience and see how it aligns with current research and best practices. The conceptual framework and findings that result may have a profound impact on school district decision-making and technology acquisition in Canada and beyond.

Statement of the Problem Situation

Given the substantial rise in technology expenditures by publicly funded school districts throughout Ontario, a deeper inquiry into the technology procurement process is vital to ensure these expenditures are informed by the relevant research, grounded in best practices, and enhance student learning. Larry Cuban (2000), the preeminent scholar on educational reform and technology spending, writes, "Given the reasons for current expenditures in technology and the paltry evidence supporting these reasons, it is time to ask again if the dollars being spent are worth it" (p. 42). With limited resources and funding, school districts and their leaders need to ensure they are being fiscally responsible and implementing technology plans that positively impact student learning. Horror stories of districts that make the mistake of utilizing technology for technology's sake are becoming increasingly common (e.g., Los Angeles Unified School District, Fort Bend Independent School District, etc.; Michels, 2013). Too often the pedagogy has been

ignored or undervalued, and the technology on its own is failing to accelerate and deepen learning (Fullan, 2013b; Militello & Friend, 2013). These are costly mistakes (both socially and financially), but more importantly they deny students and teachers opportunities those funds could have provided (e.g., professional development, program funding, etc.). Senior fellow at the Center for American Progress, Ulrich Boser (2013), has examined educational innovation extensively and addresses this very concern:

> Are taxpayers getting their money's worth when it comes to technology in schools? We simply do not know the answer to this basic question right now. Study after study shows that technology in education can raise student outcomes under certain conditions. The question now is how we can bring these outcomes to scale and at what cost. Education leaders could be doing far more in this area, including close and careful studies of technology's return on investment. (p. 8)

This study seeks to provide both education stakeholders and the broader academic community insight into how Ontario school leaders are addressing this challenge.

Purpose of the Study

The purpose of this research is to explore the decision-making process behind technology acquisition in Ontario's publicly funded school districts and how senior leaders are responding to the challenges of providing 21st century resources to students. Specifically, the study examines the procurement, governance, assessment (both technical and academic), and return on investment (ROI) measures utilized by school districts in their implementation of educational technology. Ultimately, the study seeks to examine if the technology procurement process in Ontario's publicly funded school districts is

informed by the relevant research, grounded in best practices, and enhances student learning.

Research Questions

The following question provided the overall direction for the research study:

- How do Ontario's publicly funded school districts make decisions on acquiring new technology for their school systems?

While school boards are making increased efforts to engage their stakeholders than in years past, taxpayers are still largely in the dark when it concerns technology acquisition. In order to address this gap in knowledge, the following questions guided this investigation:

- What are the most important factors senior leaders consider when procuring educational technology? Is this supported by relevant research?
- What are the governance procedures for technology procurement and spending? Is this guided/supported by data-driven decision-making?
- What kinds of assessment measures are in place to decide on the effectiveness of a technology and its impact on student learning? How do school districts measure and report on the return on this type of investment?

Rationale

Very little is known about K–12 educational technology decision-making in Canada. Research that investigates classroom technology use, leadership, and implementation, though increasing in volume, rarely explores acquisition specifically. In fact, the topic receives more focused attention in higher education, where the market is more competitive and the expenditures in IT and ICT are much larger (Botelho, 2014).

Furthermore, the roles of senior leaders like superintendents or chief information officers (CIOs) often get neglected in K–12 educational technology research in favor of school administrators (Militello & Friend, 2013), teachers (Prensky, 2008), and students (Palfrey & Gasser, 2013). Yet without senior-level leaders who are experts in technology management and advocates for the use of educational technology in classrooms, the field of education will never be able to successfully deliver 21st century learning skills to students (Courville, 2011). This study recognizes the importance of such leaders in technology acquisition and specifically examines their vital role in the decision-making process. Furthermore, there are several reasons that explain the importance of this research: (a) publicly funded school districts and the provincial government in Ontario are spending large amounts of money on technology; (b) there is very little guidance for senior-level leaders in making educational technology acquisitions; (c) the impact of technology on student learning is largely unknown.

Ontario was selected as the focus of this study due to its large size and its equally large provincial debt. While Ontario has the largest number of students enrolled in publicly funded schools of any province (Herman, 2013), it has come under heavy scrutiny due to its excessive spending and inability to institute wide-scale reform. Economist Don Drummond (2012) famously led the charge with the *Commission on the reform of Ontario's public services* report, which revealed that "provincial spending on elementary and secondary education has grown significantly over the past decade despite declining student enrolment" (p. 204). While increased funding for students may sound good on paper, it is far from sustainable. Despite these distractions, Ontario has typically performed exceptionally well on international tests, including the 2012 Programme for

International Student Assessment (PISA; Fleischman, Hopstock, Pelczar, & Shelley, 2010). However with math scores beginning to decline, stakeholders in the province are looking for sustained improvement that shifts student performance from *great* to *excellent* (Fullan, 2013a) while ensuring school districts are not spending frivolously to get there.

It is important to note that while Ontario's publicly funded school districts are spending large amounts of money on technology, they are doing so with minimal guidance from the province. Recently the Ontario Public School Boards' Association (2013) voiced their frustration with the province's lack of technology leadership and formal direction:

> Many other jurisdictions have moved vigorously ahead to define a vision to guide education well into the 21st century and we urge Ontario, which is a leader in student achievement and in education in so many spheres, to take up this challenge. This call is not inspired by considerations of funding but by a conviction that it is critical to define how we will move to keep pace with rapidly evolving technology to ensure our students are globally competitive. This is a matter of public confidence in our education system. Students, teachers, parents, school boards – all our education stakeholders – are ready to embrace this vision. (p. 1)

This research acknowledges the frustrations of these Ontario school leaders and seeks to determine if current approaches used in technology acquisition can be improved by aligning with best practices grounded in the formal literature. This will ensure that

decisions are being made in the best interests of *all* stakeholders and not under the guise that acquiring technology for technology's sake is beneficial.

Finally, this study is extremely timely in that it highlights the various ways publicly funded school districts are currently measuring the impact technology is having on student learning and the claims used to justify their purchases. It is vital that education stakeholders are aware that most of these justifications are not research validated. In fact, there is next to no research-based evidence that asserts investments in technology result in improved learning for students (Bebell et al., 2010). Larry Cuban (2001) writes,

> The introduction of information technologies into schools over the past two decades has achieved neither the transformation of teaching and learning nor the productivity gains that a reform coalition of corporate executives, public officials, parents, academics, and educators have sought. (p. 195)

This research compares and contrasts the reasons districts purchase technology against its research-validated conceptual framework and determines whether the participating school boards are making decisions that are aligned with formal research, grounded in best practices, and in enhancement of student learning.

Although a great deal of informal and industry-based research has been gathered by nonprofit organizations and professional associations (e.g., The Ontario Research and Innovation Optical Network, Consortium for School Networking, International Society for Technology in Education, etc.), the formal scholarship on large-scale K–12 technology acquisition is lacking. As mentioned previously, Canada lags behind the U.S. in their adoption of ICT, and the same can be said for its university-level research. Additionally, the examples of U.S. scholarship tend to focus on individual schools rather

than district-wide acquisition. According to Bebell et al. (2010), this gap "has created a challenging situation for educational leaders and policy makers who must use flawed and limited research evidence to make policy and funding decisions" (p. 31).

In summary, producing high-quality research has proven to be difficult for school districts due to its expensive and time-consuming nature (Bebell et al., 2010). With taxpayer dollars continuing to be spent without any formal guidance and districts expressing a lack of understanding about their respective challenges and responsibilities (Lebeaux, 2013), there is a need for a qualitative study that collects data from participants who occupy senior-level leadership positions. The detailed descriptions these participants provide are invaluable to understanding the educational technology decisions made by publicly funded school districts, but will also reveal information that formal policies and press releases do not. Utilizing case study methodology, the participants in this study are able to describe their experiences in context, so that the research community and stakeholders are better positioned to understand their actions (Lather, 1992; Robottom & Hart, 1993). The goal of this research is to use the collected data and compare and contrast it against a research-validated conceptual framework that is aligned with best practices that support student learning through the use of technology. The outcome is a unique contribution to academic research surrounding educational technology and an opportunity for stakeholders, districts, and policymakers to review decision-making practices in Ontario's publicly funded schools.

Conceptual Framework

As Soy (1997) clearly states, "Case study research excels at bringing us to an understanding of a complex issue or object and can extend experience or add strength to

what is already known through previous research" (p. 1). With stakeholders in mind, it was important that the conceptual framework for this study was designed to break down the key elements of effective senior-level technology decision-making. Both academic and professional literature was consulted to identify the most important elements of the technology decision-making process. Consequently, the conceptual framework was developed and identified the following areas of exploration (see Figure 1):

1. Technology Procurement and Spending
2. Academic Impact of Technology on Student Learning
3. Data-Driven Decision-Making (DDDM)

A review of the relevant literature in these areas was also beneficial in refining the major research questions. The key authors and bodies of research (theoretical framework) were selected to organize findings and determine whether technology decision-making in Ontario was aligned with current scholarship and with student learning as the focus. While the formal scholarship on K–12 educational technology spending is quite small (outside of IT), it was important to draw upon frameworks that outline the major factors that influence senior leaders and districts to purchase technology (Bellamy, 2007; Finkel, 2012; Fullan, 2013b; International Society for Technology in Education [ISTE], 2009; Leithwood, 2012). Next, in an effort to determine if technology acquisitions are being made with students as the primary focus, scholarship that highlights strategies for increasing student achievement were utilized (Finkel, 2012; Marzano, Pickering, & Pollock, 2001; McCombs & Whisler, 1997; Spector, 2013). Finally, literature that presented frameworks for how districts, through technology, can facilitate and support decisions across stakeholders also informed this study (Ikemoto & Marsh, 2007;

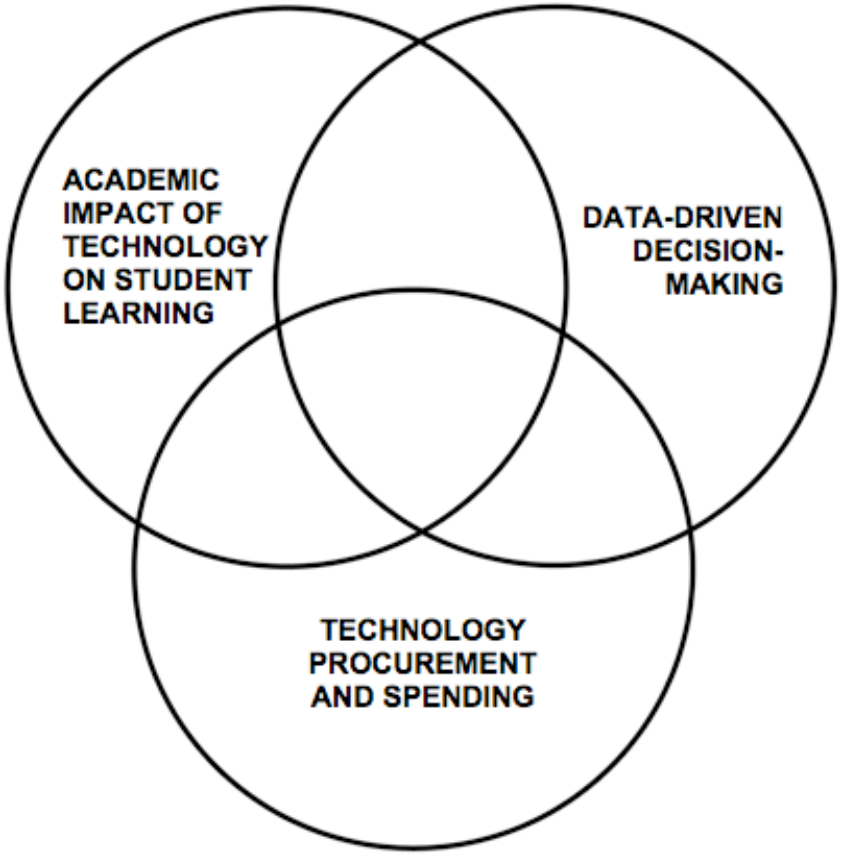

Figure 1. Conceptual framework.

Mandinach, Honey, & Light, 2006; Ministry of Education, Ontario, 2011). In summary, the literature in these three areas provides the theoretical foundation against which this case study is measured. A more in-depth exploration of the conceptual and theoretical frameworks is offered in the following chapter.

Scope and Limitations

This study focuses on the decision-making processes of publicly funded school districts in Ontario, Canada. The data were collected through in-person and online interviews with senior-level leaders in the spring/summer semester of the 2013–2014 academic year. Ten participants (from 10 different school boards) were involved in the study and their contributions represent the decision-making processes behind educational technology acquisition for approximately 746,000 Ontario students. Findings from this study may not be indicative of practices and policies across all 72 Ontario school boards; however the number of students (and other stakeholders) impacted is substantial (represents approximately 37% of the province's student population).

As a result of this study being devised under qualitative, case study methodology, findings should not be generalized or be used to represent acquisition practices in other educational institutions. School boards of medium-to-large sizes were specifically selected for exploration due to the overwhelming amount of existing research that examines individual schools or small districts across North America (Mandinach & Cline, 2013; Whitehead, Jensen, & Boschee, 2013). Furthermore, recent research shows that larger school districts in particular struggle with technology acquisition, citing challenges in communicating effectively with vast numbers of stakeholders and following intricate bureaucratic procedures (Digital Promise & Education Industry Association,

2014; Morrison et al., 2014). This research brings attention to the need for high-quality technology leadership in Ontario's K–12 schools and the challenges that the Ministry of Education needs to address through widespread reform.

Outline of the Remainder of the Document

In Chapter Two a review of the relevant literature surrounding the essential conditions to support technology implementation, the factors that affect student learning, and data-driven decision-making is presented. Chapter Three outlines the research methodology and design, selection of participants, assumptions and limitations, ethical considerations, and data collection and analysis employed in this thesis. Chapter Four presents the findings that emerged during "Computer-assisted NCT analysis" (Friese, 2014). In this chapter, the guiding research questions are used to organize the presentation of findings. The sequential organization of the *most important factors driving technology acquisition*, *research support*, *governance procedures*, *data support*, *assessment measures*, and *return on investment*, is aimed at enhancing readers' understanding of the complete decision-making process behind technology acquisition from the genesis of the idea right through to its purchase, implementation, and assessment. Chapter Five concludes the thesis with a discussion of the study's findings, their connection to the reviewed literature, and the implications for practice and future research.

CHAPTER TWO: LITERATURE REVIEW

"But as we're learning in the U.S., it's important always to start with the education challenge, and then determine which technology, if any, meets the need and adds value to other solutions. It's tempting to make it about new, glamorous gadgets – but that can distract from simpler and more effective approaches" – U.S. Secretary of Education, Arne Duncan (Department of Education, 2013).

In evaluating Duncan's address at the 2013 USAID Global Education Summit, it is clear that the U.S. is still learning from past mistakes and missed opportunities in trying to marry education and technology. His emphasis on addressing the "education challenge" (Department of Education) is echoed in much of the new research surrounding educational technology implementation and pedagogy (Avidov-Ungar & Eshet-Alkakay, 2011; Fullan, 2013a, 2013b; Prensky, 2008). But while statements like this are promising in that they address key areas for improvement and focus, they seem to fall short for stakeholders. Many feel that while their education system is addressing the need for improving educational delivery through investments in technology, they have failed to ensure that these dollars consistently promote strong student achievement (Boser, 2013). Effective technology leadership and decision-making is not something to be desired anymore, it is essential. This chapter will explore the most important facets of technology decision-making in education. To gain a better understanding of the emerging issues, challenges, and opportunities for educational leaders today, we must begin with an in-depth examination of the foundational literature used in this study. This will provide the reader with an understanding of what the key authors and bodies of research propose and whether or not Ontario's publicly funded school districts are best aligned to meet the

demands of teaching and learning in the 21st century. Finally, a detailed investigation of the relevant literature related to the study's conceptual framework will follow. It is important to note that while the majority of the educational technology research cited stems from the United States (excluding Ontario's provincial procurement guidelines), many of the emerging issues related to decision-making are quite similar from country to country (Herman, 2013). The scholarship stemming from inquiries into technology spending, its impact on student learning, and the usage of data in school districts will provide readers with a robust account of educational technology decision-making in the 21st century.

Theoretical Framework

While the overall volume and quality of educational technology research pales in comparison to most other fields of study (Bebell et al., 2010), there are several research studies that have garnered global acclaim over the last 10 years (Hsu et al., 2013). With educational technology decision-making being such a large and complex issue (still evolving), it proved very difficult to find a single theory that encompassed all of the relevant concerns and topics related to this field of study. Of growing interest is the literature surrounding the essential conditions to support technology implementation (Bellamy, 2007; Finkel, 2012; Fullan, 2013b; ISTE, 2009; Leithwood, 2012), the factors that affect student learning (Finkel, 2012; Marzano et al., 2001; McCombs & Whisler, 1997; Spector, 2013), and data-driven decision-making (Ikemoto & Marsh, 2007; Mandinach et al., 2006; Ministry of Education, Ontario, 2011).

Essential Conditions to Support Technology Implementation

As mentioned in the previous chapter, the rapid growth of technology has made it imperative that organizations have sound technology leadership and management present. Oftentimes this is done by outlining a specific vision or identifying essential conditions that need to be met in order for the organization to be successful (Gomes, 2011). While stakeholders are seeking this level of leadership and expertise at the district level, Ontario's school boards are looking to the province for direction as well. Bellamy (2007) defines technology management as "the management strategies and processes that are utilized in the effective deployment and maintenance of technology" (p. 32). Beyond management skills, a K–12 senior leader must also be an effective writer and advocate of meaningful school/district policy related to technology. For example, Brooks (2008), through her work with the province of Alberta, recommends that senior administrators need to be better supported as they attempt to create ICT policy that offers new opportunities for student learning rather than replicating the traditional classroom. In addition to shifting the education paradigm completely, researchers suggest senior administrators also need to assume leading roles in changing their district's culture (Courville, 2011; Luthra & Fochtman, 2011), creating and implementing a shared learning vision around technology (Gomes, 2011; ISTE, 2009), engaging stakeholders (Hall, 2010), and facilitating groups in becoming leaders as well (e.g., teachers, tech coaches, school librarians, etc.; Johnston, 2011), among many other tasks. Elected trustees (who formally govern school boards) weigh in on large purchases and set overall policies and budgets related to technology expenditures as well. While it may seem that senior-level leaders have a great deal of say in the technologies that are acquired, there

are many other opinions that ultimately impact the decision-making process. However the weight these opinions carry is up for debate. According to a collaborative research study executed by nonprofit group Digital Promise and the Education Industry Association (2014), most of the 300 education leaders and technology executives they interviewed reported that stakeholders close to teaching and learning (i.e., principals, teachers, and students) had limited involvement in the procurement process.

Technology implementation has also caused districts to reevaluate their views on teaching and leading in the 21st century classroom (Clarke, Gill, Sim, Patry, & Ginsler, 2014). One can look to leadership advocate Michael Fullan's (2013b) latest work, *Stratosphere*, for an in-depth exploration of the intersection between pedagogy, technology, and change knowledge in Ontario's districts. Fullan, Cuttress, and Kilcher (2005) define *change knowledge* as "understanding and insight about the process of change and the key drivers that make for successful change in practice. The presence of change knowledge does not guarantee success, but its absence ensures failure" (p. 54). The challenge in school districts is to move beyond simply avoiding failure and best position senior leaders and their teams for success. Fullan (2013b) champions *motion leadership* as a means of generating "positive movement forward for individuals, organizations, and entire systems" (p. 66). Motion leadership ensures that district leaders are constantly motivating, advising, and utilizing their large group of stakeholders while never deviating from a sustainable, system-wide approach. Daunting, yes; impossible, no. While pedagogy and technology can provide the overall directional vision for a school district in the 21st century, change knowledge is what slowly helps districts achieve it (Fullan, 2013b). It should be noted that Fullan has worked extensively over his career

with the province of Ontario, authoring many Ministry of Education documents and serving as a Special Advisor to the Premier of Ontario. However, despite Fullan's work (and the work of several other scholars) being referenced heavily in the Ministry of Education's *Ontario Leadership Framework* (OLF; Leithwood, 2012*)* and broader *Ontario Leadership Strategy* (OLS), districts are still struggling to identify with the province's vision for technology leadership (Ontario School Boards' Association, 2013).

A common question emerging in school boards is, "Businesses show the ROI for technology – why can't our school district?" (Krueger, 2013). Getting the best return on investment or ROI in technology has proven difficult for many organizations and states/provinces (Maas & Lake, 2015). Part of this challenge lies in how organizations define or capture their return on technology investment. School districts often assess both the dollars that can be saved through an investment in technology as well as the academic gains in student performance that may result. The ways districts measure *academic* ROI will be explored in a later section. According to Gomes (2011), districts that purposefully leverage technology (e.g., through cloud computing models and *Bring Your Own Device* or *BYOD* initiatives) can reduce their costs by at least 50% compared to dedicated models (i.e., frequently purchasing desktops and laptops). Several other researchers have commented on the cost saving merits of implementing technology and how reducing/eliminating paper resources and central servers in districts is beneficial in the long run (Finkel, 2012; Greaves & Hayes, 2008; Hastings, 2009). Specifically, the rise of free and inexpensive products has also presented cost-saving potential for educational institutions. For example, since Georgetown University embarked on their 5-year technology transformation strategy and migrated to *Google Apps for Education* or *GAFE*,

they are reporting savings of US$120,000 each year in software licenses (EdSurge, 2014). The switch also permitted cutting-edge applications (apps) to facilitate video-conferencing between professors and students and allowed groups to work collaboratively on documents and projects virtually. According to their website, GAFE currently has more than 30 million students, teachers, and administrators, across K–12 and postsecondary using their free suite of products (Google, 2014). The low cost of consumer technology has also allowed school districts to put devices in the hands of students that otherwise would not have access (Hastings, 2009; Kim et al.; 2010). While ensuring equity of access, repurposing taxpayer dollars, and creating innovative learning opportunities sounds good on paper, the body of research showcasing the financial challenges caused by technology implementation is also growing.

The financial implications of acquiring and supporting educational technology at the district level often go overlooked. Simply implementing technology to replace certain functions or tasks in an organization does not guarantee a reduction in costs (Finkel, 2012). Underappreciating the challenges associated with implementation is largely responsible for costly failures in district-wide adoptions of technology (Cuban, 2001; Hall, 2010). But these challenges are hardly minute. A senior leader on the board of education for the 400,000 students in Chicago's public schools readily admitted, "Not every investment is going to work. You're going to bet on different management teams and different ideas" (Cavanagh, 2014, p. 4). However, more and more research is being conducted to ensure that fewer bad investments are made. The Greaves Group, in collaboration with Jeanne Hayes of the Hayes Connection, have come together to produce *America's Digital Schools* projects/surveys (Greaves & Hayes, 2008), which

target the largest 2,500 school districts in the U.S. These reports shed light on future technological trends in K–12 education and the financial implications of meeting this need at a district level. Costly mistakes typically revolve around the following challenges (and are echoed throughout the literature):

- Lack of strategic planning and experience implementing and supporting a complex wireless environment (Bellamy, 2007; Cuban, 2001; Gomes, 2011; Greaves & Hayes, 2008)
- Inadequate or incorrect professional development (Cuban, 2001; Finkel, 2012; Greaves & Hayes, 2008; Spector, 2013)
- Lack of funding (both at the district level and state/provincial level; Boser, 2013; Cuban, 2001; Greaves & Hayes, 2008; Magolda, 2006; Morrison et al., 2014; Sundeen & D. Sundeen, 2013)
- Hardware and software problems (both technical and content based; Greaves & Hayes, 2008; Johnson & Maddux, 2008; Krueger; 2013)
- Insufficient Wi-Fi and bandwidth connectivity (Gray, Thomas, & Lewis, 2010; Greaves & Hayes, 2008)

Recently, the Bill and Melinda Gates Foundation (2014) released a hierarchical study (surveying both students and teachers) called, *Teachers Know Best*, which addresses the "mismatch between the kinds of digital instruction tools that teachers say they actually need and the kinds of products companies are creating and school districts are buying" (p. 4). The results emphasize the role of the teacher in K–12 technology acquisition and how highlighting their voices can help strengthen investments and implementation. Some key findings indicate that when teachers are given choice about

the technology their students use, they are more likely to report that product was effective. Additionally, the 3,100 teachers surveyed find the free products they use just as effective as those purchased at the district level (Bill & Melinda Gates Foundation, 2014). This is interesting for school boards because it appears to give them even more incentive to explore the free or inexpensive software and technologies available.

However, this example does not take into account the *total cost of ownership* (*TCO*) and its role in the school board gaining financial value from its technology investment (i.e., repairs, IT support, financial stability of company, etc.). For example, while many teachers may use a free product in their classrooms, it becomes challenging when they advocate for its use district wide if the company is not ready for enterprise-level implementation. School districts now have the option of *building* a personalized solution (oftentimes with a startup company or open source software) and bearing all the up-front costs or *buying* a solution (from an established vendor) and beginning wide-scale implementation much faster (Battaglino, Halderman, & Laurans, 2012). With thousands of vendors around the world attempting to get a piece of the educational technology market (Cavanagh, 2014), school leaders need to be very cautious with their investments and utilize both their technology and education knowledge in making decisions that best support student learning. Culp et al. (2005) write, "Working toward more affordable, convenient, reliable, sustainable and easy to use technology as well as adequate and relevant content resources and training continue to be only partially-achieved steps toward a goal of creating technology-rich teaching and learning environments" (p. 291).

In response to the increasing need for direction during school and district-wide technology implementations, ISTE (2009) developed the *essential conditions*. The

International Society for Technology in Education is a nonprofit professional organization of educational technology leaders (i.e., teachers, administrators, superintendents, academics, etc.) dedicated to promoting suitable uses of technology to support learning, teaching (and teacher training), and administration in PK–12. Since 1998, ISTE has developed several National Education Technology Standards (NETS) projects to help educate key stakeholders about effective technology use. Originally, ISTE faculty developed 10 essential conditions in collaboration with school and district administrators in 2000. In 2007, ISTE revised the essential conditions list (this time calling upon input from thousands of educational leaders around the world) and developed the 14 conditions that were published in 2009. This list of standards has remained largely unchanged and is being used with increasing frequency in schools and districts around the world.

The essential conditions required to effectively leverage technology for teaching and learning include: a shared vision, empowered leaders, implementation planning, consistent and adequate funding, equitable access, skilled personnel, ongoing professional learning, technical support, curriculum framework, student-centered learning, assessment and evaluation, engaged communities, support policies, and a supportive external context (ISTE, 2009).

It should be mentioned that these conditions are not all encompassing and that this framework merely outlines the *best* combination of factors needed for a successful technology rollout. A school district's failure to concretely address one of these conditions may not result in the complete breakdown of a technology's implementation,

but it may certainly complicate the rollout and create barriers to integration (Searson, Laferriere, & Nikolow, 2011).

Factors That Affect Student Learning

Researchers and practitioners have long sought a framework to guide technology implementation and to be used as a model for improving student achievement. In 1990, the American Psychological Association (APA) launched a Task Force on Psychology in Education, whose mandate was to integrate both research and theory to outline general principles (that have stood the test of time) that could comprise a framework for school reform and design (McCombs & Vakili, 2005). What resulted was the *Learner-Centered Psychological Principles*, which outlined 12 fundamental principles about learners and learning that, when evaluated in totality, "provide an integrated perspective on factors influencing learning for *all* learners" (APA Task Force on Psychology in Education, 1993). The document was then revised in 1997, and the principles were extended to 14 (APA Work Group of the Board of Educational Affairs, 1997). The 14 learner-centered principles are classified into four research-validated domains: cognitive and metacognitive factors (nature of the learning process, goals of the learning process, construction of knowledge, strategic thinking, thinking about thinking, context of learning), motivational and affective factors (motivational and emotional influences on learning, intrinsic motivation to learn, effects of motivation on effort), developmental and social factors (developmental influences on learning, social influences on learning), and individual difference factors (individual differences in learning, learning and diversity, standards and assessment; McCombs & Whisler, 1997).

In order to gain a better understanding of this framework, an exploration of the term "learner centered" is required. McCombs and Whisler (1997), two of the leading authors and leaders in learner-centered research, write:

> "Learner centered" is the perspective that couples a focus on individual learners – their heredity, experiences, perspectives, backgrounds, talents, interests, capabilities, and needs – with a focus on learning – the best available knowledge about learning and how it occurs and about teaching practices that are most effective in promoting the highest levels of motivations, learning, and achievement for all learners. This dual focus then informs and drives educational decision making. Learner-centered is a reflection in practice of the *Learner-Centered Psychological Principles* – in the programs, practices, policies, and people that support learning for all. (p. 9)

This definition aligns well with the overarching goals and polices that govern Ontario education.

Similar to the work of McCombs and Whisler (1997), Marzano et al. (2001) surveyed the existing research base on effective classroom instruction. Based on their analysis of the literature, Marzano et al. created nine categories of instructional strategies that affect student achievement. These strategies include: identifying similarities and differences, summarizing and note taking, reinforcing effort and providing recognition, homework and practice, nonlinguistic representations, cooperative learning, setting objectives and providing feedback, generating and testing hypotheses, and questions, cues, and advance organizers (Marzano et al., 2001). Rooted in theory, these approaches

to instruction have been proven to have an impact in the classroom and yield reliable gains in student performance on standardized testing (22–45%).

Furthermore, recent research has begun to examine the role of standardized testing as a targeted measurement of the academic impact of technology on student learning. In Ontario, standardized tests are conducted by the *Education Quality and Accountability Office* (EQAO) annually and measure students' academic performance in grades 3, 6, 9, and 10. The EQAO recently announced that Ontario's standardized testing will shift from paper-based to online delivery in the 2015–2016 school year. No further details have been provided in regards to its implementation.

Despite there being very little empirical evidence to support the use of formal testing to assess technology's effect on academic performance (Bebell et al., 2010), districts continue to factor it into their decision-making processes. For example, Greaves and Hayes (2008) highlight several examples in their report in which school districts highlight sharp improvements in their standardized test scores as a result of technology being implemented in the classroom. The authors reference a study by Gulek and Demirtas (2005), where 259 middle school students were tracked and assessed during a 1:1 laptop initiative. Greaves and Hayes (2008) write:

> The baseline data for all measures showed that before enrollment in the program there was no statistically significant difference in English language arts, mathematics, writing, and overall grade point average achievement between laptop and non-laptop students. However, laptop students showed significantly higher achievement in nearly all measures after one year in the program. (p. 67)

These types of "pre" and "post" tests are largely anecdotal (Bebell et al., 2010; Hratinski

& Keller, 2007) and don't necessarily draw any significant parallels or effective empirical formulas that can be replicated across school districts. To date, no such metric exists.

Over the last decade, there has been a large pushback against the merits of standardized testing in education from teacher unions (Ontario Secondary School Teachers' Federation [OSSTF] and Elementary Teachers' Federation of Ontario [ETFO]). With the rise of ICT and a move towards more personalized learning, this pushback has only grown. Militello and Friend (2013) describe the accountability movement and its current focus on student achievement data as "excessive" (p. 82). Additionally, Bebell et al. (2010) propose that standardized tests are not necessarily aligned with the technologies being purchased for districts and therefore lose their overall purpose (i.e., standardized tests tend to measure fact recall and broad knowledge, which are not the central focus of educational technology use in education). The authors suggest, "Rather than employing state test results, one alternate strategy is to develop customized tests that contain a larger number of items specifically aligned to the types of learning that the educational technology is designed to affect" (Bebell et al., 2010, p. 44). While (additional) customizable testing might be a hard sell for stakeholders, it seems more purposeful than the current methods of assessing student learning through technology.

With standardized testing being a rather controversial measure of assessing technology's impact on student learning, other measures are being used to calculate school districts' *academic* return on investment. Despite Fullan (2013b) writing that he finds "little evidence of the impact of technology on learning" (p. 39), student learning

arguably looks very different today than in generations past. While the accountability movement's emphasis on test scores is still relevant, academic ROI in 2014 is largely measured by student engagement (Finkel, 2012). If students come to school excited to learn and the technology helps them remain focused on the task at hand, districts will value that connection. Finkel's (2012) article also draws attention to "rates of completion" as another method of measuring academic ROI on technology. In studying an online school within the Chicago Public Schools (CPS) district, he found that "online students complete their work at a higher rate (81 percent vs. 77 percent) than the district students as a whole, and their graduation rate of 96 percent is higher than the state's rate of 80 percent" (Finkel, 2012, p. 80). One-to-one (1:1) computing has also shown a difference in the way students are learning and demonstrating their knowledge (Greaves & Hayes, 2008; Johnson and Maddux, 2008). While the researcher acknowledges that unbiased research on 1:1 rollouts can be difficult to find (and even more difficult to isolate technology as the direct cause of improved student achievement), Jackson (2004) surveyed the research and highlighted the following:

- Increased quality and quantity in writing
- Greater student collaboration
- Greater teacher awareness of student progress
- Improved organizational skills
- More project-based learning
- More learning beyond the classroom
- Increased student engagement
- Preparation for tomorrow's workplace

However, more robust work needs to be done in showcasing the myriad of ways technology is being used in the classroom and the overall academic benefits for districts and their students (Bebell et al., 2010). While the formal research advocating for technology integration in education has been spotty (in terms of both quality and quantity), the evidence is slowly accumulating (Johnson & Maddux, 2008).

Often overlooked, it is important to account for the role of teachers in any technology implementation effort. In order to regain a positive academic ROI, districts need to ensure they are also evaluating teacher uses of technology. The research indicates that the best predictors of students' achievements are primarily related to teachers' efforts and not the technology itself (Avidov-Ungar & Eshet-Alkakay, 2011). If districts can get their teachers to buy in to their technology plans, their chances for success dramatically increase. Throughout the research, quality professional development for teachers is highlighted as an essential component of any successful technology implementation (Blow & McConnell, 2012; Culp et al., 2005; Finkel, 2012; Greaves & Hayes, 2008; Hall, 2010; Johnson & Maddux, 2008). Spector (2013) writes, "Without proper training of teachers and others, it is likely that new technologies will suffer the fate of so many educational technologies of the past – little impact on learning and marginal adoption rates" (p. 21).

Likewise, Greaves and Hayes (2008) highlight several benefits and challenges technology has posed for teachers, both in convenience (saving time) and growing their professional practice. For example, the authors reference studies in the U.K. that indicate interactive whiteboards are being successfully used as a time-saving method for instructors; however districts in the U.S. are reporting mixed results in terms of the

academic benefits stemming from their use of whiteboards. An instructional technology specialist in Riverside Unified School District in California (which has approximately 500 interactive whiteboards) says, "I can take a great teacher and teach them technology, but I can't take a good technician and teach them how to be an effective teacher" (p. 81). Clearly, technological skill does not guarantee effective instruction for students. However, the potential of educational technology as a means of engaging learners and personalizing their educational experience should not go overlooked (Kim et al., 2010). Fullan (2013b) writes,

> Technology, especially as it is now becoming, will be a great partner in this profound learning enterprise. But equally we need the new pedagogy to be a dynamic partner. We need learners proactively in charge of their own learning-how-to-learn. And for the latter we need teachers and other mentors who can design and oversee the learning process . . . . Technology will loom increasingly large as a player. If we get this right, ultimately what we want and what technology wants in education will be the same thing. (p. 32)

Data-Driven Decision-Making

Since the accountability movement in education took hold over the last 20 years (and especially since the enactment of the No Child Left Behind Act of 2001 in the U.S.), school districts are being asked to use assessment data and test scores to drive their decision-making. However, this practice is hardly new. Mandinach and Honey (2008) write, "Teachers have used a wide range of data sources – from in-class assignments to pop quizzes and homework – to make judgments about their students' understandings" (p. 1). Yet what is new is that data use and analysis have become expected of teachers,

principals, and senior-level decision-makers, in an effort to keep publicly funded school districts accountable to governments and local taxpayers. This shift has impacted every area of public education from the classroom (where teachers are expected to deliver and balance both formative and summative assessments; Mandinach & Honey, 2008), to the principal's office (where student achievement results like report cards and EQAO testing are analyzed), and finally at the district level (where resource allocation is determined by trustees' and other senior leaders' evaluation of both educational and financial data; Ikemoto & Marsh, 2007; Mandinach & Honey, 2008).

Innovations in both IT and ICT have only created more opportunities for data collection, analysis, and decision-making in both private and public institutions. Despite these innovations, there is great inconsistency in how educational leaders define data-driven decision-making and the techniques they use to analyze and interpret their data. This study uses Ikemoto and Marsh's (2007) definition of data-driven decision-making or DDDM as "teachers, principals, and administrators systematically collecting and analyzing data to guide a range of decisions to help improve the success of students and schools" (p. 108). One of the foremost researchers in the field of data-driven decision-making is Ellen Mandinach. In 2006, Mandinach et al. created a conceptual framework (rooted in both literature and research on practitioners) that displays DDDM as a continuum in which data are transformed into information and ultimately to knowledge (see Figure 2). They write:

> It is important to note that this model presented here depicts decisions made within school districts, focusing on the classroom, building, and district levels. No doubt many variables at the state and local levels can and will impact local

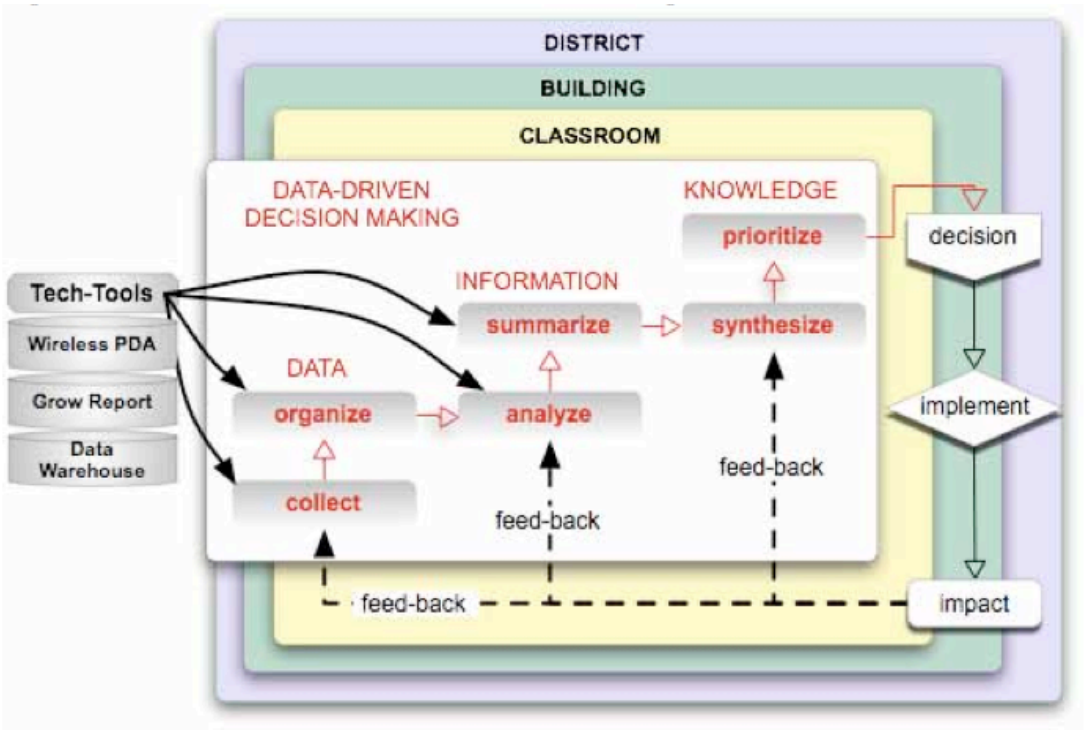

Figure 2. Framework for data-driven decision making.

Note: From "A theoretical framework for data-driven decision making," by E.B. Mandinach, et al., 2006, Paper presented at the annual meeting of the American Educational Research Association, p. 7.

decisions, but our intention here is to examine local decisions (Mandinach et al., 2006, p. 6).

The Framework for Data-Driven Decision Making is made up of three key components: (a) Data-Driven Decision Making Skills; (b) Levels of the School System; and (c) The Role of the Technology-Based Tools.

Data-Driven Decision Making Skills

As displayed in Figure 2, "at the data level, the two relevant skills are 'collect' and 'organize'. The skills at the information level are 'analyze' and 'summarize'. At the knowledge level, 'synthesize' and 'prioritize' are the skills seen as relevant" (Mandinach et al., 2006, p. 8). Once the stakeholder has completed these six steps, a *decision* is made. The decision is then *implemented* (or not implemented if complications arise). Finally, the implementation generates an *impact*, which can then inform the decision-maker if one of the six steps needs to be revisited (creating a feedback loop).

Levels of the School System

The authors acknowledge that the types of decisions being made and types of data being collected vary across classrooms, schools, and districts. Mandinach et al. (2006) write, "In examining cross-level decision making, it is likely that there will be more top-down decisions than bottom-up decisions" (p. 10). The school district culture and overall leadership play key roles in how decisions utilizing data are facilitated at each level and within levels as well.

The Role of the Technology-Based Tools

When districts evaluate what technologies to purchase and implement, the products' role in the feedback loop and relation to data capturing, storage, and analysis is

sometimes overlooked. The authors posit, “The added value for the use of technology in data-driven decision making is becoming increasingly clear” (Mandinach et al., 2006, p. 10). However, it is important to note that across different levels of the school system the interactions between the technological tools, generated data, and stakeholders are quite complex. To simplify these intricacies, the researchers identify several functionalities that impact how a tool will be used: (a) accessibility; (b) length of the feedback loop; (c) comprehensibility; (d) flexibility; (e) alignment; and (f) links to instruction.

With school districts having great difficulty translating theory into practice, it is important to review scholarship that possesses practical significance as well. To better understand the opportunities of DDDM today, Mandinach and Honey (2008) present two interlocking requirements:

1. Instructor and administrator acceptance and use of data-driven decision making; and
2. Technologies that facilitate the timely and consistent use of data for that purpose. (p. 192)

Additionally, Ikemoto and Marsh (2007) highlight several factors that impact data-driven decision-making, including accessibility, timeliness, perceived validity, staff capacity and support, and organizational leadership.

The opportunities for DDDM to personalize learning, refine decision-making, and implement education reform throughout schools are astounding. For instance, educational technology implementation has allowed vendors to automatically collect data and analyze it for senior-level leaders to make informed decisions (Greaves & Hayes, 2008; Ikemoto & Marsh, 2007). This would provide administrators and leaders with an opportunity to

make decisions based on already analyzed data rather than being bogged down in the collection and analysis stages. However, privacy concerns and the confidentiality of student data have prevented wide-scale adoption of this practice. Furthermore, organizations now have access to targeted measures that ensure that their acquisitions are purposeful and not implementations of technology for technology's sake. School data has also been used to address inequities between urban and rural schools (Kim et al., 2010). For example, districts can now assess at any given time how many student devices are connected to the school board's Wi-Fi and compare that with the socioeconomic demographics of each school. Perhaps a "disadvantaged" school has more students participating in BYOD initiatives than a senior leader assumed. Administrators are now encouraged to investigate deeper (rather than spend carelessly) and make choices and acquisitions that truly impact the lives of students. This would not have been possible before the rise of technology and DDDM. Mandinach and Honey (2008) write, "The acquisition of technology tools that easily and efficiently support users' needs, a robust and cohesive technological infrastructure, and targeted professional development go a long way in establishing the use of data throughout a school system" (p. 3). It is becoming increasingly clear how important the procurement of technology is and how it relates to supporting student learning and district-wide accountability.

The Ministry of Education, Ontario (2009) has made great strides in publishing literature on the merits of data-driven decision-making (DDDM) and chose to align the practice with their Ontario leadership framework (OLF) in 2009. The five core leadership capacities (CLCs) the Ministry of Education (2009) highlight are:

- Setting goals

- Aligning resources with priorities
- Promoting collaborative learning cultures
- Using data
- Engaging in courageous conversations (p. 1).

With the rise of both consumer and educational technology, its increased presence in schools, and the monumental amount of data available to stakeholders, the Ministry chose to revisit data use in education in 2011's "Using Data: Transforming Potential into Practice" document. Once again the use of data is innately tied to the five CLCs (Ministry of Education, Ontario, 2009). Furthermore, the document outlines how DDDM is embedded in the Ontario leadership framework. Despite the vast amount of useful information present, simply reading the report can become overwhelming. Implementing these practices in real contexts sounds even more difficult. However, Ontario has key organizations, tailored policies, and platforms which assist in the handling of educational data and to aid teachers and administrators in the decision-making process:

- Managing Information for Student Achievement (MISA)
    - Ontario School Information System (OnSIS)
    - Elementary/Secondary Data Warehouse (ESDW)
- EQAO
- The Student Success Strategy
- The Professional Learning Cycle
- The Teaching-Learning Critical Pathway Cycle (T-LCP)

Despite the report's overall difficulty to follow, EQAO has reported on several occasions that many Ontario schools have reported gains in their standardized test scores as a result

of "their leadership, data-driven strategies and whole-school approaches to helping every child succeed" (Education Quality and Accountability Office, 2011).

Notwithstanding the clear advantages DDDM presents to school districts and the technology acquisition process, it also presents numerous challenges. While the resources Ontario has put forth blend education and organizational leadership theories/documents, much of the formal scholarship on DDDM advocates for the unaltered use of the theoretical frameworks proposed (Mandinach & Honey, 2008). Many policies (like the ones implemented in Ontario) also assume that data use is a straightforward process and that decisions will routinely be enhanced by practices of DDDM (Ikemoto & Marsh, 2007). This is even more apparent at the classroom and school levels, where there is a huge misconception about what DDDM looks like in practice. Bebell et al. (2010) highlight the fact that many schools have shifted their stakeholder surveys from paper based to Web based. However, what these schools fail to acknowledge is that simply transferring the process online does not typically generate any new kinds of data (it simply streamlines the process). Many administrators struggle with leveraging technology in ways that move beyond computer-based representations of traditional paper-and-pencil surveys. For data-driven decision-making to truly have an impact in education, students, teachers, and administrators need to refine their 21st century learning skills (The Partnership for 21st Century Skills, 2011) in order to be able to manage and make sense of large amounts of data (Gomes, 2011).

Conceptual Framework

This conceptual framework represents the best thinking about technology acquisition in school districts and has been developed in part by reviewing the relevant

literature. Surveying the scholarship was highly beneficial in identifying the most important elements of the technology decision-making process. The following areas of exploration were outlined:

1. Technology procurement and spending
2. Academic impact of technology on student learning
3. Data-driven decision-making (DDDM).

In order for senior leaders to make decisions at the district level that are aligned with formal research, grounded in best practices, and in enhancement of student learning, they must consider these three areas (refer back to Figure 1 in Chapter One). Furthermore, the literature review revealed three specific conditions in each area that relate to educational technology decision-making. It is important to note that while there are many ideal conditions involved in the technology decision-making process, only the factors related to the areas of exploration of this study were included. The result of this process is a comprehensive framework that is rooted in the relevant literature.

Technology Procurement and Spending

Total cost of ownership (TCO). This framework draws on the work of Krueger (2013) and Greaves and Hayes (2008) and highlights the need for senior leaders to be cognizant of total cost of ownership when they go to market. Krueger writes, "To get started, you must understand the cost of a technology initiative over the life of the project . . . . Initial purchases, training, and implementation costs must be amortized or annualized, and ongoing costs must be added in" (p. 26). Greaves and Hayes also recognize that "initial costs, maintenance costs, and TCO are all important factors for schools" (p. 97). With school districts moving to 1:1 computing models at a rapid rate

(Jackson, 2004; Johnson & Maddux, 2008), it is imperative that all costs are accounted for before hardware/software is purchased and continuously assessed throughout its rollout and implementation.

Organizational vision. The literature draws attention to an overall district vision as imperative for sound technology decision-making and leadership (Fullan, 2013b; Gomes, 2011; Hall, 2010; ISTE, 2009). If a technology does not fit within the broader vision and goals of the school board, then it should not be purchased. Furthermore, school leaders need to ensure that the policies they create align well with the technologies they are implementing. Finally, the overall organizational vision should be informed by the *entire* organization. ISTE (2009) focuses on "teachers and support staff, school and district administrators, teacher educators, students, parents, and the community" (p. 1). In a publicly funded institution, stakeholders should work collaboratively to ensure that they are all working towards the same goals. Once this vision is established, leaders at various levels need to ensure that the technology's implementation is monitored and that any triumphs or challenges encountered are further explored (Hall, 2010).

Efficacious funding. In order for school districts to avoid implementation failures, they need to determine whether the amount of funding they have (and will have in the future) is enough to successfully purchase, deploy, and assess a new technology (Boser, 2013; Cuban, 2001; Greaves & Hayes, 2008; Magolda, 2006; Sundeen & Sundeen, 2013). ISTE (2009) advises district leaders to acknowledge the importance of continuous and adequate funding in any technology acquisition as well.

Academic Impact of Technology on Student Learning

Teacher training. As mentioned previously, for any technology implementation to have a high rate of success, the role of the teacher needs to be constantly considered (Avidov-Ungar & Eshet-Alkakay, 2011). In particular, professional learning and development for educators is universally identified in the literature as an essential condition for efficacious technology procurement and implementation (Blow & McConnell, 2012; Culp et al., 2005; Finkel, 2012; Greaves & Hayes, 2008; Hall, 2010; ISTE, 2009; Johnson & Maddux, 2008; Spector, 2013). This training can take on many forms and can be provided by individual teachers, administrators, corporate vendors, and even students.

Increased student engagement. According to Finkel (2012), aside from standardized test scores, student engagement is the biggest measurement districts are currently using to assess the academic ROI on a technology purchase. This claim is aligned with both the APA's (1997) learner-centered framework and Marzano et al.'s (2001) nine categories of instructional strategies that affect student achievement. Drawing from the developmental and social factors, the APA Work Group of the Board of Educational Affairs (1997) outlines *developmental influences on learning* as the consideration that "individuals learn best when material is appropriate to their developmental level and is presented in an enjoyable and interesting way" (p. 5). Marzano et al. similarly emphasize the importance of increasing student engagement among multiple strategies. For example, the researchers promote the use of *nonlinguistic representations* during instruction to engage students in different ways of thinking (e.g., elaborative thinking; Marzano et al., 2001). Prior to purchasing new technology, senior

leaders should be assessing the technology currently being used in their schools and the level of student engagement that results. Many times this can be accomplished by launching a smaller pilot study before making a large-scale purchase. However, these pilots need to be monitored very closely and produce data and observations that go beyond basic paper-and-pencil surveys.

Collaboration. Implementing technology in classrooms can facilitate collaboration in a number of ways that would have otherwise not been possible. Providing students with equitable access to technology can allow *all* children to participate collaboratively in the learning process. Additionally, flipped classrooms, online tutoring, instructional software, and so on can provide relevant and engaging instruction in which students can collaborate with both teachers and their peers at any time (i.e., both at school and at home). Most important, an emphasis on facilitating collaboration to increase student achievement is present in the research. Once again both the APA's (1997) learner-centered framework (*social influences on learning*) and Marzano et al.'s (2001) nine categories of instructional strategies that affect student achievement (*cooperative learning*) mention learning through collaboration. The APA (1997) found through their research that "learning can be enhanced when the learner has an opportunity to interact and to collaborate with others on instructional tasks" (p. 5). While globalization and the knowledge economy have allowed people to connect with one another via the Internet and share information at any time, the ability to work collaboratively with others is still a *learned* practice.

Data-Driven Decision-Making

Timeliness. Simply put, analyzing standardized test results once a year is not a timely analysis of student performance data. In their analyses of data-driven decision making, Ikemoto and Marsh (2007) found that "individuals in many districts across both studies commonly complained that state test data were not timely" (p. 120). Similarly, Greaves and Hayes (2008) discovered that on more than one occasion the results from paper-based standardized tests arrived only after the next school year had already begun. This is unacceptable. Providing students with opportunities for online instruction and assessment can produce immediate results. With the Internet and technological tools providing students with real-time feedback in their personal lives (e.g., video games, text messaging, etc.), teachers and administrators need to be given the tools to deliver the same feedback in classrooms (Mandinach et al., 2006).

Accessibility. Along with providing timely feedback, data tools need to be accessible to relevant stakeholders (i.e. teachers, students, principals, senior leaders). Mandinach et al. (2006) define accessibility as "how easy the tool is to access and use" (p. 10). Similarly, Ikemoto and Marsh (2007) found that if the access to data is not easy, it will not be utilized. This is a significant barrier to employing the use of data-driven decision-making and needs to be addressed before districts can claim they are aligned with Ontario's leadership framework (Ministry of Education, Ontario, 2011). The document clearly states that school leaders are expected to "access, analyze, and interpret data" (Ministry of Education, Ontario, 2011, p. 17). This conceptual framework advocates that districts purchase technologies that create *easy* data outputs (aside from

some hardware that may lack that capability) which can be used to evaluate student performance and inform future purchases.

Capacity. One of the biggest challenges in employing the use of data-driven decision-making in school districts is a lack of technical capability. While a school board's IT department has access to a variety of student data (e.g., contact information, academic records, number of devices on network, etc.) and can analyze the data to inform decision-making, teachers and administrators lack that ability. Mandinach et al. (2006) found that "as a result, teachers' decision making strategies often lack systematicity, from student-to-student, class-to-class, and year-to-year, are unintentionally tinged with personal bias, and ignore key statistical concepts like distribution, variation, and reliability" (p. 2). The need for *quality* data collection was also found throughout the literature (Gomes, 2011; Ikemoto & Marsh, 2007; Mandinach & Honey, 2008; Mandinach et al., 2006). In order for this to occur, this conceptual framework advises that districts either pursue technologies or partnerships with vendors that *build* the district's technical capacity to analyze/use data in their decision-making (e.g., procuring subject-specific software that provides data analysis of student performance) or ensure that personnel are being put in place to analyze the data emerging from existing technologies (i.e. *data coach*; Ikemoto & Marsh, 2007).

Leadership

While sound technology management and leadership cannot be attributed to just one area of the conceptual framework, it is essential in making research-validated technology decisions. Nearly all the literature consulted, with the exception of the APA's (1997) learner-centered framework and Marzano et al.'s (2001) nine categories of

instructional strategies that affect student achievement, cited effective leadership as critical (Bellamy, 2007; Courville, 2011; Finkel, 2012; Fullan, 2013b; Gomes, 2011; Greaves & Hayes, 2008; Hall, 2010; Johnson & Maddux, 2008; Johnston, 2011; Luthra & Fochtman, 2011; Spector, 2013). As mentioned previously, this conceptual framework recognizes the importance of technology leadership throughout the entire decision-making process and the individuals (at varied levels throughout a school district) who are helping transform learning.

Research-Validated Framework of Technology Decision-Making

Based on the literature review of existing research on technology decision-making, a research model has been developed that is aligned with the study's conceptual framework. The research model is used as a basic expectation of senior leaders who are making technology decisions at the district level (see Figure 3).

Chapter Summary

This chapter provided an in-depth analysis of the key documents related to this study's theoretical framework. Subsequently, the conceptual framework was presented and highlighted the relevant literature and voices in the areas of technology acquisition and spending, academic impact of technology on student learning, and data-driven decision-making. Policies and scholarship related to Ontario's education system in particular were highlighted as well. The next chapter outlines the research design and methodology for the study

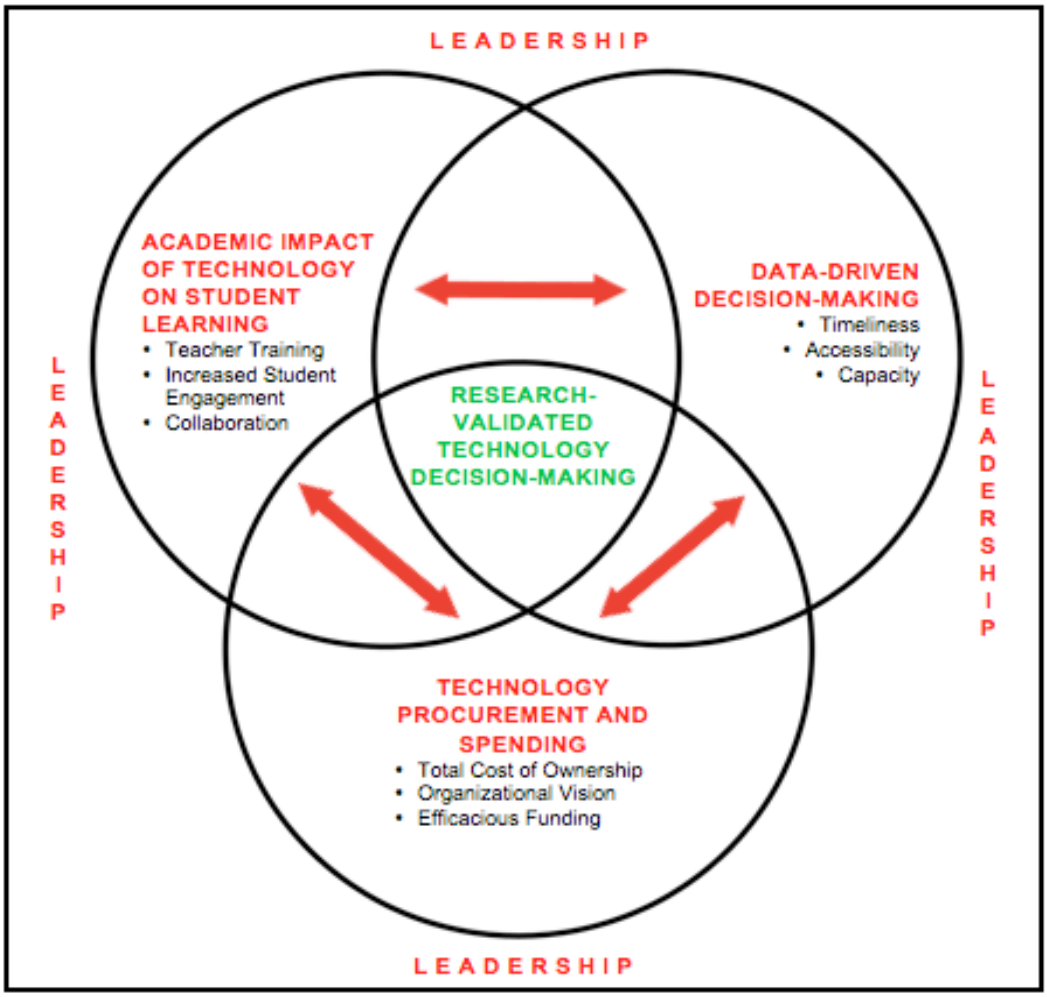

Figure 3. Research validated framework of technology decision-making.

CHAPTER THREE: RESEARCH DESIGN AND METHODOLOGY

"'Google' is not a synonym for 'research.'" (Dan Brown, 2009, p. 124).

The purpose of this chapter is to examine the methodology and techniques that were utilized in completing this study. This section begins with an explanation of the research design, the participant and site selection process, the data collection, processing, and analysis, and concludes with assumptions made about the data, limitations, and ethical considerations that were taken into account.

Research Design

The aim of this research was to explore the decision-making process behind technology procurement in Ontario's publicly funded school districts. It appears to be the first investigation of educational technology acquisition in Canada that calls upon the viewpoints of senior-level leaders. This study employed a case study approach as a research strategy within broader qualitative research using both face-to-face and online interviews and a myriad of internal/external school board documents. It was important to gain a greater understanding of the contemporary phenomenon of educational technology decision-making currently taking place in Ontario's publicly funded school boards. Though senior leaders in school districts have had to decide on classroom technology for the last 30 years, the emergence (and consumerization) of ICT and the Internet has brought new challenges and opportunities to organizations. As a taxpayer, educator, and student, this was of great interest to the researcher and others throughout the province. This study aligns with Stake's (1995) view of case study research that "we enter the scene with a sincere interest in learning how [actors] function in ordinary pursuits and milieus and with a willingness to put aside many presumptions while we learn" (p. 1).

Although educational technology research is dominated by qualitative studies (Bebell et al., 2010; Hratinski & Keller, 2007; Hsu et al., 2013), technology spending, its academic impact, and data-driven decision-making have not been studied in combination to determine how senior leaders make educational technology decisions. Other studies tend to focus on student and teacher technology interactions but neglect how senior leaders (i.e., CIOs and superintendents) facilitate those opportunities through taxpayer dollars, provincial funding, and fundraising.

It is important to note that as public organizations, school districts make acquisitions differently than private businesses, and their allocation of resources is more dependent on policy than market forces and supply and demand. Despite this fundamental difference, the challenges large school boards face at an enterprise level are just as substantial as those occurring in large-size corporations. As a result, a case study approach was best suited as it highlights the *context* of real-life phenomena that are highly valued in qualitative research conducted in both public organizations and businesses (Farquhar, 2012). Furthermore, this investigation satisfies the need for a study that synthesizes recent research (Hratinski & Keller, 2007) and was essential to this exploration of educational technology decision-making.

Selection of Participants and Site

This research is best described as a *collective case study*, in which the decision-making processes surrounding technology are evaluated in 10 different Ontario publicly funded school boards (Creswell, 2013). Participants were selected using purposeful sampling in which, as Creswell (2013) writes, “the inquirer selects individuals and sites for study because they can purposefully inform an understanding of the research

problem and central phenomenon in the study" (p. 156). Therefore, it was important to select individuals who are in leadership positions and make high-level decisions regarding school technology acquisitions, assessments, and analyses. These individuals typically hold the title of "Chief Information Officer" (CIO) or "Superintendent" and possess the status, experience, and knowledge required for this study. Potential participants were identified through school board websites and as attendees of CONNECT 2014: Canada's Learning and Technology Conference, using the publicly available Conference Agenda and Speakers List. As conference attendees, these individuals either were or had recently been engaged in the process of discovering new technological resources. However, participants were not recruited at the conference.

A letter of invitation to participate in either an online or face-to-face interview was emailed to 24 senior leaders in Ontario out of a potential 72 publicly funded school districts. It was decided that the study would need at least 10 senior leaders to participate for the findings to be both impactful and manageable for a Master's thesis. Once the 10th interview had been scheduled, the researcher no longer accepted participation requests. Prior to commencing the interviews, the interviewees were provided with a letter of informed consent that outlined their right to decline to answer any questions, to refuse to participate in any component of the study, or to withdraw from the study at any time without any penalty. The site of each interview was chosen at the discretion of the participant. Four interviews took place in person (at the individual school board's main office), and six interviews were completed online (three via Skype, two via Google Hangout, and one via FaceTime). Each interviewee was asked a combination of both open-ended and closed-ended questions (see Appendix A), and each interview took

between 60 and 90 minutes to complete. At the conclusion of the interviews, the interviewees were asked to outline any policies or internal/external documents (e.g., budget reports, workflow maps, etc.) that would help the researcher further contextualize their responses to questions. These documents were then emailed to the researcher at a subsequent date.

Instrumentation

For the exploration of the central phenomenon of this study, a semistructured interview design with mostly open-ended questions (as well as a few closed-ended questions) was deemed appropriate. While qualitative research largely uses open-ended questions, some closed questions were required to ensure that the issue being explored was viewed in the proper *context*. With technology interests and issues being so pervasive in common discussion and emerging scholarly research, it was important that participants were not ambiguous with their responses and why supporting documents were requested by the researcher. This notion aligns with case study methodology in which the context needs to be highlighted (Farquhar, 2012). The semistructured interview design was chosen to give participants ample time and scope to communicate their diverse views and allow the researcher to react in real time and pose follow-up questions on emerging ideas (Nohl, 2009). The semistructured interview was comprised of 22 primary questions (see Appendix A); however a participant's response could answer several questions at once. The results obtained through the semistructured interviews can also be compared with one another since all participants were required to express their views about the same general themes (Nohl, 2009).

The questions were developed based on a survey of existing literature, the research questions, and current technology trends/topics that were emerging in both professional and general discourse. The researcher's thesis supervisor and committee members also contributed ideas about word selection and the combination of open-ended and closed-ended questions prior to the interviews being conducted. Finally, the study's conceptual framework, which identifies the areas of technology procurement and spending, academic impact of technology on student learning, and data-driven decision-making as key in decision-making, was used to create the organizational flow of the questions. The key authors and bodies of research in combination developed a theoretical framework against which the findings of the study were measured.

Data Collection

Interviews were conducted over the spring/summer semester of the 2013–2014 academic year. Each interview was audio-recorded on both the researcher's iPhone 4S (using "Voice Memos") and Apple MacBook (using "QuickTime Player"). The recordings were transcribed the day after each interview by the researcher and took anywhere from 2–5 days to complete. District-specific policies and internal/external documents were received intermittently from participants between June and November 2014.

Qualitative Data Processing and Analysis

The analytic approach that was used in this collective case study research is "Computer-assisted NCT analysis" (Friese, 2014) using ATLAS.ti, a computer-aided qualitative data analysis software (CAQDAS). With a sizeable amount of transcripts and

policy documents to analyze, the researcher felt that computer software would serve both an organizational and analytical purpose for this study. Friese (2014) writes,

> Software frees you from all those tasks that a machine can do much more effectively, like modifying code words and coded segments, retrieving data based on various criteria, searching for words, integrating material in one place, attaching notes and finding them again, counting the numbers of coded incidences, offering overviews at various stages of a project, and so on. (p. 1)

Computer-assisted NCT analysis is adapted from Seidel (1998) and is comprised of three basic components, which are *noticing* things, *collecting* things, and *thinking* about things. These three basic elements are common to a large range of analytical practices in qualitative research and Creswell's (2013) five research traditions in particular.

The first phase of the NCT method required the researcher to notice interesting things in the data (e.g., transcripts, reports, newspaper articles, etc.) and write down notes or attach preliminary codes (see Appendix B). At this stage, the level of code is not particularly important. It should be noted that the research questions, interview questions, and relevant scholarly literature were coded as well in order to develop preliminary connections and codes present in the data.

The second phase involved the researcher collecting similar items under existing, new, or merged code labels. Although NCT analysis does not prescribe any particular way of coding, this study employed the use of both deductively and inductively developed codes (Friese, 2014). The researcher sought out areas that draw connections to the study's conceptual framework and was facilitated by creating three *code groups* that divided each transcript according to the overarching research questions (see Appendix C).

The final phase engaged the researcher in deeper thinking after coding and the use of ATLAS.ti tools like the *Code Cooccurrence Table* and *Word Cruncher* functions to discover patterns and processes across the cases (see Appendix D). Additionally, participant responses were tallied and summed for particular questions based on frequency of mention (e.g., the most important factors driving technology acquisition were established by evaluating what the most common/frequent responses were amongst the participants). While an attempt was made to move in sequence from noticing, then to collecting, and finally to thinking, a *recursive* process (moving back and forth between noticing and collecting) proved to be more fruitful in discovering connections and relationships (Friese, 2014). It was incredibly important to use the NCT method in this collective case study in order to use the *full* functionality of ATLAS.ti in analyzing the data. The researcher paid particular attention to any themes that emerged from the data that had not been previously accounted for. The result of this process is illustrated and discussed in Chapters Four and Five.

Assumptions and Limitations

The main assumption of the study was that CIOs and superintendents would not be able to answer each of the 22 primary questions on behalf of their district without prior preparation and engaging members of their team. As a result of this assumption, the interview questions were emailed to participants at least one week in advance of the scheduled meetings so they would have time to prepare thoughtful and informed responses. While this may have an impact on the outcome of the research findings, the researcher felt it improved the quality and specificity of the participant responses.

A limitation of this study was the inclusion of only 10 participants (speaking on behalf of their individual school districts) due to time constraints. Although 746,000 students (37% of the province's student population enrolled in these publicly funded school boards) represent a large impact in Ontario, it becomes difficult to make generalizations about the other 62 publicly funded school boards that did not participate. Thus, a collective case study methodology was chosen so that these 10 disparate sites and perspectives could be linked by context.

Ethical Considerations

Prior to contacting any potential participants, the ethics application for this study was reviewed by the university's Research Ethics Board and granted clearance (file #13-287). It was the researcher's belief that senior leaders in Ontario's publicly funded school districts stood to benefit from the opportunity to discuss their decision-making surrounding educational technology acquisitions. These benefits included an opportunity to examine how other districts are procuring technology, whether the challenges being faced are similar, and whether solutions exist to better support students. Furthermore, the dissemination of this research will also allow senior leaders to address the lack of stakeholder knowledge about technology decision-making and fill in gaps that are present in both the literature and common discourse. The education community at large will gain knowledge from this study, which can then be used to refine decision-making practices in school boards, foster further collaboration between school districts, and allow innovative partners to provide districts with cost-effective solutions that support student learning.

To ensure that districts and their stakeholders were protected, participant identities and the identities of their affiliated school boards, team members, and so on were either removed from the transcripts, or assigned pseudonyms. Signed consent forms and audio-recorded statements of consent were collected prior to beginning the interviews. Furthermore, once the interview had been transcribed, it was checked with the audio to ensure it had been typed verbatim. Validation was sought from participants through a member check as well (Creswell, 2013; Tracy, 2010). Each participant was provided a copy of the transcribed interview and was allowed to make changes in areas where he or she may have misspoken or neglected to include pertinent information (through "Track Changes"). Overall, the transcripts required only minor changes prior to analysis. Additionally, the researcher took great care in ensuring that excerpts from the interviews could not be attributed to any identifiable school district or board-specific technology initiative. Policy documents were used only to contextualize information present in the interview transcripts and to gain a better understanding of the entire decision-making process.

Chapter Summary

This chapter outlined the research methodology and design of this collective case study which examined the decision-making process surrounding educational technology acquisition in Ontario's publicly funded school districts. Using a qualitative design, a computer-assisted NCT method was employed to analyze interview data and policy documents. Consideration has been given to the limitations of this research. The findings of the study are presented in the next chapter.

CHAPTER FOUR: FINDINGS

"I remind myself every morning: Nothing I say this day will teach me anything. So if I'm going to learn, I must do it by listening." – Larry King (Maxwell, 2008, para. 4).

The purpose of this research was to examine the decision-making process regarding technology procurement by senior-level leaders in Ontario's publicly funded school boards. Three broad questions served to guide the research:

- What are the most important factors senior leaders consider when procuring educational technology? Is this supported by relevant research?
- What are the governance procedures for technology procurement and spending? Is this guided/supported by data-driven decision-making?
- What kinds of assessment measures are in place to decide on the effectiveness of a technology and its impact on student learning? How do school districts measure and report on the return on this type of investment?

The 10 participants were senior-level decision-makers who currently hold leadership positions in Ontario's publicly funded school districts. They are identified by the pseudonyms of Amanda, Anthony, Clive, Daniel, Gabriela, Julia, Megan, Nicholas, Stan, and Walter. The pseudonyms selected are not reflective of the particular participant's gender. Table 1 provides a description of each senior leader and his or her respective school district. Of the 10 participants, four held the position of "Chief Information Officer" and four held the position of "Superintendent." Revealing the titles of the other two participants could risk identifying them. Six senior leaders had job responsibilities that were largely nonacademic (i.e., facilities, IT, human resources, etc.), while four senior leaders had mostly academic responsibilities (i.e., learning, education,

Table 1

Description of Senior Leaders and Their School Districts

Pseudonym	Position	Main responsibilities	No. of students	No. of teachers	No. of schools	Size
Amanda	Superintendent	Academic	Under 50,000	Under 3,000	50 to 100	Medium
Anthony	Superintendent	Academic	50,000 to 100,000	3,000 to 6,000	100 to 200	Large
Clive	/	Nonacademic	Above 100,000	Above 6,000	Above 200	Very large
Daniel	Superintendent	Academic	Above 100,000	Above 6,000	Above 200	Very large
Gabriela	/	Academic	50,000 to 100,000	Above 6,000	100 to 200	Large
Julia	Superintendent	Nonacademic	Under 50,000	Under 3,000	50 to 100	Medium
Megan	CIO	Nonacademic	Under 50,000	Under 3,000	50 to 100	Medium
Nicholas	CIO	Nonacademic	50,000 to 100,000	3,000 to 6,000	100 to 200	Large
Stan	CIO	Nonacademic	50,000 to 100,000	Above 6,000	100 to 200	Large
Walter	CIO	Nonacademic	Under 50,000	Under 3,000	50 to 100	Medium

Note. Clive and Gabriela's position titles were purposely left off because revealing them could potentially identify them to readers.

etc.). Two boards had a student population that exceeded 100,000, four had between 50,000 and 100,000 students, while four others had enrolment numbers below 50,000. Four boards had a teaching staff that exceeded 6,000, two had between 3,000 and 6,000, and four others had fewer than 3,000 employed teachers. In terms of the number of schools within their districts, four senior leaders were serving over 50 schools, another four had over 100 schools, and two were responsible for over 200 schools. Given that the focus of this study is on the acquisition of educational technology, board size was determined based on the number of students enrolled in each district. Given that the boards with the lowest numbers of students in the sample still had higher enrolment numbers than some of the smallest boards in Ontario, none could be categorized as "small" in size. Instead, participating districts were categorized as either medium, large, or very large based on their current student enrolment.

An inductive analysis of the data followed the interviews. In this chapter, the guiding research questions are used to organize the presentation of findings. The sequential organization of the following six sections is aimed at enhancing readers' understanding of the complete decision-making process behind technology acquisition from the genesis of the idea right through to its purchase, implementation, and assessment.

Most Important Factors Driving Technology Acquisition

The data revealed that the 10 senior leaders participating in this study considered many of the same factors when acquiring technology for their school districts. However, it also revealed that each school district's unique set of circumstances (e.g., small/large board size, financial stability, geographic location, etc.) directly informed the emphasis

they placed on particular factors. In discussing the process, they all acknowledged numerous challenges in determining what technologies to purchase for their stakeholders and the leadership and management tools needed to provide direction to their organizations. During the interviews, participants were asked to *identify* and *rank* the most important factors they consider when procuring technology for their school districts. In reviewing the data, the most common response (in terms of frequency) was (1) cost-related factors, which was mentioned by all 10 senior leaders. Next, (2) impact on school board infrastructure was considered by nine of the participants. Seven senior leaders deliberated (3) product specifications, and four measured a product's (4) alignment with technology plan/organizational vision. Finally, three participants considered (5) the impact of technology on instruction and student learning when purchasing hardware/software. Table 2 shows the participants' responses. While some senior leaders listed other factors they considered in the procurement process, they were not frequent or significant when measured against the sample.

Cost-Related Factors

All 10 participants stressed the importance of various cost-related factors when considering purchasing new technology resources for their school districts. However, some explained that the process involved much more than just evaluating the list price of a technology and that cost was not the ultimate driver of their decision-making.

> Well, I do not think you talk about price without talking about total cost of ownership. Because you know that price is only one of the components of total cost of ownership. And, you know, what I would say total cost of ownership includes is not just the acquisition price, it is the costs associated with the support,

Table 2

Most Important Factors Driving Technology Acquisition

Amanda	Anthony	Clive	Daniel	Gabriela	Julia	Megan	Nicholas	Stan	Walter
Compatibility with existing network (1)	Accessibility (1)	Affordability/ price	Needs of the organization (1)	Technology plan	Functionality (1)	Affordability/ Price (1)	Technology plan (1)	Technology plan/ organizational goals	Compatibility with existing network (1a)
Affordability/ price (2)	Sustainability	Sustainability	Organizational goals	Access/ mobility	Best allocation of resources (2)	Sustainability (2)	Professional development	Access/ mobility	Cost-saving potential (1b)
Functionality (3)	Technology plan	Compatibility with existing network	Professional development	Pedagogy	Affordability/ price		Sustainability	Infrastructure	Industry research (2)
Mobility (4)	Pedagogy	Access/ mobility	Affordability/ price	Compatibility with existing network	Cost-saving potential		Infrastructure	Affordability/ price	Sustainability
Assistive features (5)			Durability	Assistive features	Durability		Affordability/ price	Sustainability	Affordability/ price
End user feedback (6)				Affordability/ price	Supportability		Functionality		Durability
				Sustainability	Manageability		Durability		Assistive features
					Access/ mobility		Student learning		

Note. Some participants were able to rank the factors in terms of their importance. The rankings are reflected in parenthesized numbers.

> which include maintenance . . . . You know, the cost to install it . . . So price is not our number one. (Nicholas)

Despite this claim, cost-related factors and their role in technology decision-making were emphasized throughout most of the interviews. Nine participants emphasized (a) affordability/price; seven discussed (b) sustainability; and two mentioned (c) cost-saving potential. Only Julia considered if the purchase of a technology represented the best allocation of the district's resources (see Table 3).

Affordability/price. Nine senior leaders identified affordability/price as a prominent factor affecting purchasing decisions.

> Price is always, always an impact. (Amanda)
>
> So there are really two factors. There is affordability, which is obviously the fact that we need to have the budget, and sustainability, which in some respect is related to the former. (Megan)
>
> We look at affordability. We decide where we want to go, what we want to do with what the budget is, and then go through a tender process. (Daniel)

When asked about the influence the price of the technology has on a potential acquisition, participants provided several examples where high prices deterred their organizations from procuring certain software/hardware.

> Cost is really important and sometimes cost will put things out of our reach. So a 1:1 project would be out of our reach because sheer cost would put it out of reach. (Amanda)
>
> I'll give you an example: We don't have enough money to put Wi-Fi wall-to-wall in our school district. I need several million dollars to do that. Funding is not in

Table 3

Cost-Related Factors

Factor	Mentions
Price/affordability	9
Sustainability	7
Cost-saving potential	2
Best allocation of resources	1

Note. Mentions refers to the number of senior leaders that cited each factor.

place. (Clive).

Some participants said the circumstances surrounding the acquisition in particular impacted their organization's emphasis on price.

> It is on the list and again depending on the need. So if the need is that I have to get very quickly a lot of machinery out there for whatever reason, then the lowest price machine that meets the needs is probably what I am going to look at. If though somebody is coming at me with a bottom-of-the-line tablet, Linux or Android tablet or something like that, which they are now under $100 each, I am not going to buy them because they are junk and it is just going to frustrate the kids and so on. So price is a factor but it is not the ultimate factor. (Gabriela)
>
> So to get back to your question about price and capability, every situation is different. Sometimes you need commodity-based materials. If we need to buy a bunch of keyboards, I just need to make sure that we have some reliability metrics on them to know that they are going to last. Certain vendors put a tremendous amount of energy and investment into ensuring that their products will last and that they are going to be durable. As a result, you might pay a slight premium for that product. (Walter)

Clive noted that some technology vendors are more willing than others to work with publicly funded school districts in providing affordable solutions for their classrooms. Unlike other organizations, school boards are not able to generate revenue and must conserve what they spend. To him, vendors should be more willing to make their products/services affordable and recognize the potential that lies in working with the K–12 public sector: large user base (i.e., thousands of students, teachers, administrators,

parents, etc.) and the potential to tap into a close-knit community (72 Ontario school districts).

> Whenever we talk to any vendor the list price is always high. As a joke I tell them, "In the K–12 sector we love 90% discounts." So the marketplace has changed a bit and companies like Google have stepped up where they are giving a lot of freebies to the K–12 sector. That has forced other big guns like Microsoft to follow the same model. But some of the other companies are not following that model and it is hurting academics and it is also hurting the companies; companies like Adobe. Adobe has gone into a licensing model, which is in the cloud. It is online. You subscribe to it. But the prices are so high and every school cannot afford it. (Clive)

Sustainability. Seven school leaders reported that the sustainability of a new technology needed to be considered before it is purchased. Three participants noted that the costs associated with implementing the technology (either in a single school or across a district) have to be accounted for up front.

> So when the technology decisions are made, some of those things are highlighted upfront at the rollout stage saying "To sustain this environment, you are going to need this in place." This could be buying or hiring additional resources to manage that piece or it could be bringing in additional technology to do that piece. So that has to be an upfront cost as we roll out those pieces, not at the tail end. (Clive)
>
> So I am not going out and buying tons of stuff if I have the money today because it has to be sustainable. The cost of the machine is not the machine, as you have probably heard from the other boards. It is training, backup, and support, and

> everything like that. If I am going to be spending all that money up front to train and get everybody running and finally I find out in 2 years time that I cannot replace the machines if they all die, I may get a subset of them to work on a project or something but it is not going to be a wide-scale purchase because it is not sustainable. (Gabriela)
>
> So affordability and sustainability are absolutely key. As you are probably aware, we recognize that the cost of acquisition is often just the smallest component of overall technology costs. So do we have the human resources to continue its operation within our parameters over the time frame that we want? So on and so forth. (Megan)

The descriptions of sustainable funding were varied across the interviews. Some of the senior leaders emphasized that funding needs to be secured through the board of trustees and allocated for several years in advance.

> So the way we roll out technology is we have been able to secure 5 years of funding. So again through that strategic process, one of the things ISTE talked about was you need to have a regular source of funding. You know, how do you plan unless you know how much money you have? (Nicholas)
>
> So they came up with timelines saying by September 2016 we are going to have a decent Wi-Fi presence everywhere in the district. How are we going to make that happen? We started lining up funding around that. (Clive)

Other participants pointed to individual costs associated with support. For instance, Stan and Anthony are constantly considering the ongoing need (and expense) of

IT support, and Daniel and Amanda choose to spend dollars frequently on professional development for their staff.

> IT has to support this at the end of the day. So we want more of the products that are being used in a meaningful and relevant way in the classroom and are sustainable. So that might mean we need to pay for it. (Stan)
>
> So right now we have landed on a standard and that just happened. That process occurred last year. So what is the process of that? The process is we did a review. We had to explain why we needed a standard so it can be sustainable. We had schools who had purchased cheap technology and then a year or two later we were asking IT to support it or we were trying to replace it. (Anthony)
>
> We also from a school perspective do not roll out any technology unless there is professional development associated with it. (Daniel)
>
> So we spend PD dollars quite a bit in trying to create that space where you and I can talk about how we are going to assess a kid. (Amanda)

Cost-saving potential. Participants were asked if they were more prone to want to acquire cheap or free technology/technological tools given the growth of Canadian startup companies and the Open Source movement. The weariness that cheap/free technology would not actually save the organization money in the long term figured very heavily in participants' responses. In fact, the majority of participants did not consider the resources "free" at all.

> Well you have probably heard from other places, and I think you have based on the next couple of questions, but free is not necessarily "free." I can get free software and then I pay for all the support, and all the training, and all of the

> maintenance, and all of the upgrades. I could pay for something upfront and the company pays for the maintenance, the support, and the upgrades. Your call. (Gabriela)
>
> I mean in terms of numbers, free things are very expensive . . . . Other freebie stuff we have been very cautious of because it is usually not free. In terms of the ability to service and support it, impact on our infrastructure, so on and so forth. So we are very, very careful about software in particular or services that we acquire. (Megan)

Both Megan and Clive (who work for medium and very large-size school boards respectively) communicated that the challenge in working with a startup company that may offer a cheaper product/service than an established vendor is that they are simply not enterprise ready. Today, even Ontario's smallest school districts have more end users than many global corporations. Experimenting with a new or nonestablished company introduces some risk to public sector organizations.

> Yeah, and we have experienced that over the years where we bought a piece of software; the company was starting to really just go into market with it. They wanted to use our use of it as a promotional item to say our board is using it and so they made it available very, very cheap. Well it turned out they were not able to sell it. The marketplace did not really want it. Now they are coming back and dramatically increasing their annual service fees because they cannot sustain it because they have only sold to three or four folks. So once burned, twice shy. You have got to learn not to do that anymore. (Megan)

> And there are some vendors whose products are not ready for us. But we tell them "You are not ready for us. You are okay with a small board. You can work with 10,000 students but you are not going to be able to handle our workload." (Clive)

It should be noted that when participants shared their experiences working with vendors offering cheap or free products/services, five of the 10 leaders reported highly positive experiences integrating either Google Apps for Education or Microsoft Office 365 (completely free products) throughout their districts.

In discovering that it would be difficult to save money by acquiring cheap or free technologies, some school leaders explored other ways to cut costs. Four participants discussed refurbishing old computers they had already purchased for use in the classrooms. Though the hardware lacked complete functionality, they could be used effectively for basic classroom tasks like Internet browsing and word processing. When discussing her school district's use of previously acquired technology, Amanda reported that the practice was in fact having a positive impact on their students' learning.

> So this is one where it looks like, "Well this technology could potentially be going on the scrap heap, but hang on a second. Maybe we have a little bit of life left in it and we can keep an ongoing supply for these kids." It is just sufficient enough to give them the bump up to do the work that they need to do and our initial books suggest it made a difference for them. (Amanda)

> And personally I do not like to see waste. I am a big fan of getting as much efficiency and effectiveness as you can out of something. (Walter)

Some participants attempted to divert funding from other areas and increase efficiency within their organization so they could justify spending the money on

technology for their school district. These cost-saving efforts included repurposing dollars currently spent on obsolete resources and encouraging students to bring their own devices (BYOD) to school, thus alleviating the need for hardware purchases from the school or the district. Both Anthony and Julia considered the cost-saving potential of implementing a new technology in the acquisition process.

> So for example, for us to deploy every student from grade 4–12 in our system with their own tablet . . . it costs us about 18 to 20 million dollars. On a given year, if you look at paper resources, photocopying, obsolete resources, we probably spend 18 to 20 million dollars in one year. So we looked at it from a blended approach. If we start repurposing our dollars, could we fulfill this vision? And we believe we can. (Anthony)
>
> Our whole philosophy in IT is as you are seeing these new opportunities come, I am decommissioning old stuff and I am recapturing the savings and reinvesting (Julia).
>
> So last year we rolled out a wireless implementation across the school board with the expectation that kids would be bringing in their own devices and it may reduce the costs of us providing computing equipment, or essentially screens to access Internet content, and it would help us in providing technologies so that we could redirect some funding to some other urgent areas. Because there is always competition for money. Where is it going to go? Where is it best spent? And if we can divert some of the funding from buying laptops and desktops and tablets and these types of things and if Johnny or Mary is going to bring in their laptop and

five or six kids can huddle around them, then maybe we can buy one less laptop for a classroom. (Walter)

School leaders occupying a CIO or superintendent position related to technology need to be effective managers of district resources and familiar with the needs of their entire organization. The hope is that their capacity for leadership and industry knowledge allows them to invest taxpayer dollars in technologies/services that enhance the performance of their organization (i.e., improved student achievement). According to the interview data, cost-related factors weigh heavily on their decision-making surrounding technology acquisition for their school districts.

Impact on School Board Infrastructure

Of almost equal importance to cost-related factors was the impact a new technology would have on the school board's infrastructure. Nine participants emphasized that the strength of their organization's current wireless network factored heavily into their decision-making. Specifically, five senior leaders stated that infrastructure-related concerns were the most important considerations they accounted for at the beginning of every potential technology purchase. Five participants emphasized (a) access/mobility and four discussed (b) compatibility with the existing network. In addition, Julia identified supportability and manageability as key factors she considered in the decision-making process (see Table 4).

Access and mobility. In the course of sharing their experiences acquiring technology, five participants described their current focus on providing *all* stakeholders with access to resources and core services through devices. The most common way to do this identified by participants was through increasing the district's Wi-Fi presence. Not

Table 4

Impact on School Board Infrastructure

Factor	Mentions
Access/mobility	5
Compatibility with existing network	4
Supportability	1
Manageability	1

Note. Mentions refers to the number of senior leaders that cited each factor.

only would this allow students, teachers, and administrators the ability to access online content (through either board-provided devices or personal devices), it would allow them to be mobile. When debating whether or not to purchase a new technology, school leaders said they needed to evaluate both the technology's ability to support mobile learning and their network's ability to provide support and a "robust" wireless presence.

Stan described a meeting with his staff 5 years ago in which they discussed the overall technology goals of their school district. Upon deciding that they wanted to increase the amount of access students had to online learning materials, the board realized that this would not be possible with their current wireless infrastructure and lack of wireless technology. They opted to build the capacity of their organization and invested heavily into ramping up their infrastructure.

> So we say "Okay our goal is about ubiquitous access to learning resources." So we look at technologies that are going to facilitate that. So we really focused . . . and I am going to go back to 5 years ago on enabling technologies. And we felt at that time our focus in the acquisition of technology needed to be on infrastructure. After deciding that we significantly needed the infrastructure, we then bought routers, switches, and wireless technology in an effort to provide an environment that was both ready for ubiquitous access, whether that be board-provisioned mobile technology or BYOD. (Stan)

Megan also reported that her district's Wi-Fi presence had greatly increased over the years. It not only provides better Internet access to stakeholders but also improves her department's control and servicing of the wireless access points in schools.

> We have got every school covered with Wi-Fi, both elementary and secondary. Very robust, centrally controlled wireless. We can remotely service and access all the access points. (Megan)

Similarly, after conducting an internal review of their school district, Anthony and his department also recognized that his organization lacked capacity in providing students with access to wireless content or mobile learning opportunities.

> The most important factor we talk about is accessibility for students. We did a review last year and we had over 40 different models out there that we could not support as a system. So we actually put a pause on purchases from my office. (Anthony)

This freeze on purchases allowed the district to pool funding together and divert it towards investments in infrastructure that would allow them to purchase technologies that could be supported by the system.

> We wanted a fresh start. We were looking for the best product that would be the best tool to engage kids. It has to be portable, accessible and with our wireless infrastructure, which will be completed by December, we also knew that tablets were something we wanted to explore. (Anthony)

While Anthony focused on improving the board's wireless infrastructure so that they could provide students with adequately supported devices, Nicholas, Julia, and Clive focused more on supporting devices that were being brought *into* the learning space.

> I mentioned about the network and the need for infrastructure. We used to be very into providing devices to schools. That is going to go away. (Nicholas)

Julia attributed her approach to the way technology is currently being used around the world.

> It is really more of a web-based, app-based, mobile world now . . . if I am going to look at core services like email or video conferencing, all I really care about is whether the devices can run those services and if the user can access those services on the device . . . . And really what I am concerned about is "Can I actually easily make it almost like a turnkey approach for a user?" So that no matter what device they selected, they bring it in and they can access the services they need to be able to work in their environment. (Julia)

Clive's approach was informed by the fact that not all of the students in his district needed new devices. Instead, students were demanding that the strength of the Wi-Fi in their schools be increased to support their smartphones, laptops, tablets, and so on.

> So we looked at it saying, "What can we actually do to help the schools build capacity?" So we established that for every 50 students, we will make sure there is one access point in the school. The modern-day access point can handle up to 100 devices so we almost are doubling that capacity in a way. Every kid has at least two devices on them. We used that model to build that framework . . . . Even on the classroom side of things, when we push technology out, a lot of schools who belong to rich areas are not hungry for technology. Kids are bringing in technology already. They are more hungry in making sure their infrastructure is robust. (Clive)

Compatibility with the existing network. Four of the participants acknowledged that compatibility with their organization's existing network (i.e., wireless infrastructure,

current hardware/software, human resources, etc.) was very important in technology acquisition and minimized the amount of changes that would occur during implementation.

> Compatibility with our existing network is a huge, huge factor. Probably number one . . . that it would fit in with our existing technology, our existing infrastructure and not involve large changes. (Amanda)

Like Amanda, Walter also referred to the important role compatibility played in technology acquisition. Walter expressed that an ideal purchase would be one that could be supported by the knowledge and training his staff already possessed. It would take a longer period of time to build the capacity of his staff (i.e., training) and network if a new technology could not be easily integrated within the district's existing infrastructure.

> So as it relates to technology acquisition, the first thing is how compatible is it? How much affinity does it have with what we have? Because if I already have people that understand the system management interface of a tool or a technology, whether it be networking equipment or storage equipment, then if we go with that vendor again, they are operating things from the same pane of glass. So you do not need retraining or you need limited retraining. The implementation time is quicker. The operation is easier . . . . You know you can apply one patch rather than several. There is less risk involved. (Walter)

Referring to the existing knowledge and expertise of their IT staff members, Amanda and Walter expressed that compatibility was not relegated just to technology-to-technology integrations. Amanda described her district's practice of purposefully limiting the different types of devices they acquire so that the IT staff could adequately support

the technology. Amanda explained that IT technicians should not be expected to know how to support every piece of software/hardware and that this practice would allow them to provide stakeholders with better overall technical support.

> We have "techs" or technicians that are designed to go out and provide hands-on support with all of our tech across the system in both administrative and educational settings. We cannot expect them to know every flavor and thing. So we are pretty tightly controlled on the devices we bring in so that our techs can be trained in a particular way and can provide more immediate service. (Amanda)

Similarly, Walter expressed that members of his staff should not be expected to work outside of their subject matter expertise if only a small number of stakeholders are using a particular technology.

> We cannot afford to have too much diversification in technology. Otherwise it is death by a thousand cuts and we get bled from the expectation that we are technical people so we must help them with these products, even though every product is so different that it is not about technology it is about subject matter expertise. And we just do not have the time to afford to ramp up subject matter expertise on something that is going to be used by a fraction of the school board. (Walter)

Outside of network concerns, Anthony and Clive reported that it was important for school leaders to prioritize which technologies they would build their organizations around. Anthony acknowledged that in order for new digital resources to be acquired for students and teachers, they needed to be made accessible through the board's learning management system (LMS), Desire2Learn. It was important that teachers and students

had one point of access for content and that access was made easy for students through a single sign-on (SSO). If vendors were not willing to make their product compatible with D2L, they were not considered for purchase.

> So one of our criteria for resources in the digital world is that we want it through Desire2Learn. We have a learning management system. It has got to be through D2L. We want teachers to have one point of access and if you cannot adapt yours to work with our D2L and our people, then we do not want to put another link to your website and log in. So we have some criteria that we are sticking close to. (Anthony)

Similarly, Clive emphasized the importance of having a single sign-on for students and staff and that the technology being considered for purchase needed to be compatible with his district's current student information system (SIS).

> We have a formal "portfolio management" or "intake of project" process, which we look at and say "Well this is the piece now. What needs to happen? How is it going to integrate into our environment? Is there a single sign-on?" Simple things like that. Nothing too complicated. "How does it integrate when it comes to data? This application might need teacher data or classroom data. How is it going to work with our student information system?" Things like that. (Clive)

The responses surrounding compatibility's role in technology acquisition revealed that some districts struggled with centrally supporting some devices/services. For instance, Gabriela communicated that one of the biggest challenges related to infrastructure was trying to support technologies or software that were not compatible with the school board's network. She emphasized the necessity of creating enough

workarounds so that those students and teachers using natively unsupported technologies could have a basic level of connectivity so they could "function" during the day. However, Gabriela readily admitted that the process was not 100% effective.

It is evident that senior leaders are very weary of purchasing technologies that cannot be supported by the capacity of their district's wireless infrastructure. According to participants, a technology's impact on school board infrastructure is a fundamental consideration during the acquisition process. The participants voiced the challenges associated with supporting technology at a central level and the role IT staff plays in ensuring core services are being delivered to stakeholders. Once a framework of support had been established throughout their districts, many senior leaders focused their acquisitions on increasing stakeholders' access to connectivity services and providing extra mobility for students and staff.

Product Specifications

In comparison to the previous two factors, product specifications were less apparent in the data when senior leaders described technology acquisition. However, seven participants did state that one of the important considerations they make in the purchasing process surrounds what the product *does* and whether the technology meets the criteria of the organization. Specifically, five senior leaders identified (a) durability; three mentioned (b1) functionality; and three named (b2) assistive features as key specifications they evaluate when acquiring technology for their school districts (see Table 5).

Durability. At various points during the interviews all 10 participants provided me with examples recounting how the poor quality or repairability of a product they had

Table 5

Product Specifications

Factor	Mentions
Durability	5
Functionality	3
Assistive features	3

Note. Mentions refers to the number of senior leaders that cited each factor.

purchased posed challenges to their organization. Nonetheless, this section of the research study focused on the motivating factors behind acquisition, and five senior leaders accounted for the importance of durability up front.

> Then we base it on durability. Whether it met completely the needs that we set out. (Daniel)

It was previously noted by Walter that purchasing a product that is known to be durable might require his district to pay a slight premium for that technology. He went on to speak about how a difference of a few thousand dollars between competing technologies could mark the difference between one product failure over 8 years and 2,500. For him, the quality of a product was a key factor in whether the technology was eventually purchased.

> However, over the long term, if you buy 10,000 laptops from vendor X that has highly reliable systems and you only have one failure over 8 years on that product, versus maybe saving a couple thousand dollars because a vendor was a little bit cheaper and then you end up having 25% failures in that product. It is pretty easy to do the math to understand that your initial decision to go with the cheaper product did not make sense. It was not in the best interest of the taxpayer. So to summarize, when we make decisions on procurement, the real key is to not think short term. If you think long term and you are inclusive of things like . . . actually these are some of the hallmarks of quality: reliability, durability, usability, you know these types of things . . . I think there are seven or eight dimensions to quality . . . . These are the things that you need to think about. And

> if you just hit those seven items when you make a decision, it is very easy to rationalize it in a way. (Walter)

Both Anthony and Stan provided interesting examples of the role product warranties and protection plans play in safeguarding their organizations from device failures or repairability costs. Stan described that board-provided devices may break or malfunction in the hands of students but that he expected this to happen. After all, device issues were prevalent even in his own team's use of school board technology. Purchasing a warranty on all devices acquired made him feel more comfortable.

> But we buy these devices with complete care on them, very much like we do a classroom device . . . . Stuff breaks. We know that just from our own use. (Stan)

However, Anthony cited concerns he had when schools were purchasing "low-quality" products that did not have warranty protection on them. Not only would this result in additional costs for the district, but it would also divert human resources from other areas to fix the devices.

> Well I think there are a couple of things. One is the quality of the tool. The durability of the tool. You are putting resources out for a tool that might not be durable and within a year or two you are asking for someone to fix it. There is no warranty. (Anthony)

Functionality. The purpose that the technology was expected to fulfill was also a key consideration senior leaders made related to product specifications. Three participants expressed that functionality was a key factor they assessed when acquiring new technology. Julia highlighted the importance of functionality from the very beginning of our conversation.

> So probably the single most important factor when you are making these decisions is "Does the actual delivered functionality meet the requirement?" . . . some of it has to do with the life cycle; some of it has to do with the supportability, manageability, repairability of that kind of device. Really we look at it pretty dispassionately. It is functionality and how do I get the functionality for the best possible life cycle cost. (Julia)

Julia went on to discuss the importance functionality has in maintaining equitable technology allocation across her school district and how that responsibility weighed heavily on her job as a superintendent. She reported that by assuring that the technology her department purchased effectively served the needs of students and staff, it would establish a baseline of functionality throughout the system. That way, if the administration at a particular school did not have an overarching interest in incorporating technology, the students and staff would be well served by the devices/software acquired by the board.

> Really my job is to guarantee every school has a base level of functionality in their environment. And if you get a principal who changes next year and they do not like technology, and that is not what their emphasis is, and they want to replace all the instruments for the band instead of buying iPads, at least we know that that school has a base level of functionality. (Julia)

When Amanda was asked what factors drove her district's technology acquisition, she listed functionality as a key concern behind the technology's compatibility with the existing network and the price of the product. She also conveyed that functionality went beyond just serving the *basic* needs of her organization's students and staff. Amanda

identified key product specifications and how they were essential in making the technology useful for stakeholders.

> Ease of use for students and staff . . . and when you get into really, really device-specific things, we are wanting things that are going to be most useful over the course of a day. So boot speed, battery life, clock speed of the computer are all really, really important. (Amanda)

Assistive features. Ensuring that the technology being considered for purchase came with assistive features for students with disabilities or specific learning needs was important to a few senior leaders. Three participants expressed that assistive features were key capabilities they looked for in the products they evaluated. For Amanda, they were the fifth most important factor she considered during the acquisition process.

> As well as the assistive sort of things that are part of technology, most things like [tablets] and such come with other voice-to-text, text-to-voice type things. So we look for those quotes as well. (Amanda)

When Gabriela was asked what factors drove her acquisition decisions, she made reference to the assistive tools needed to complement other technologies and their overall ability to help the board's Special Educations students.

> The next piece in there is the assistive piece. So it could be carts of computers, it could be interactive projectors, it could be whatever it takes for the tool to meet those needs. "Spec Ed" is next on the list. A lot of our Spec Ed kids, we call them [acronym], has to be bought for presumably obvious reasons to meet their needs. (Gabriela)

Despite focusing on cost and infrastructure-related concerns during much of his answer, Walter spoke passionately about his focus on his district's Special Education students when purchasing technology. For him, he felt it was his moral responsibility to advocate for those students that are disadvantaged when they come to school.

> With one exception and that is with Special Education where you need an elevation of those kids that are disadvantaged. And it is your social and ethical and moral responsibility to give them every advantage that you can so that they will succeed in a life where they are constantly going to be dealing with obstacles that you and I take for granted, like stepping up on the step or carrying a laptop. (Walter)

He went on to say that in each acquisition the needs of these students should be accounted for up front.

> And I am mindful that as we are procuring hardware or software, we should be thinking about the accessibility so that if we need to meet the needs of people that are maybe hard of hearing or have visual impairments or physical impairments, we actually should be accounting for them right up front with every acquisition. (Walter)

Walter provided an example of how his district managed to address these needs in the procurement process. He described that if he were looking to acquire 1,000 laptops he would automatically ensure that 3% (or 30 units) came with a larger display and touch screen functionalities to accommodate those students with visual impairments. Walter also felt that his school board could be doing more to help.

> So one of the dimensions of that that I have been thinking of is really extending our investment into our Special Education workspaces to make sure that we are factoring in their needs when we make those decisions. (Walter)

Participants recognized that a product's specifications play an important role in ensuring that the needs of their organizations are met and that their end users are able to use the technology effectively. The voices of participants indicate their focus on making long-term purchases that will maximize use of technology dollars and stakeholder access to devices/software.

Alignment with Technology Plan/Organizational Vision

A prospective acquisition's alignment to the school district's existing technology plan and/or organizational vision appeared to be important to some senior leaders. Five participants made reference to overarching (formal) documents that were actively guiding their current and future technology acquisitions. Most plans involved 5-year technology implementations and were readily accessible online.

Four participants reported that their districts had technology plans that had been developed internally, while one participant's organization had adopted an external technology standard. Gabriela outlined her efforts in writing and publishing a technology plan that was disseminated throughout the district.

> The current iteration of things is I wrote and published a technology plan amidst the district 3 years ago. We just finished year two of it. It is a 5-year plan and the plan is on our website and it is all about going mobile and in a culture of accessing mobility. So the plan had many steps to conclusion. So the technologies

> that were purchased three years ago went towards the first part of the plan. (Gabriela)

Using the board's technology plan, Gabriela and her staff were able to gauge how fast their organization was progressing and whether they were meeting their yearly targets (and overall vision). She also expressed that because the technology marketplace was constantly shifting, it was difficult to fully see the plan through in its current form. When we spoke, Gabriela had already begun drafting a new technology plan that better expressed the current direction the district was heading in.

> So what I can I do is I see that as my metrics. So here is where we are against our plan. It is getting a little "wonky" now 3 years into it. Technology plans do not usually survive 5 years as you can tell. So at 3 years I am starting to revise it and come up with a new one for next year based on the things I have learned. (Gabriela)

On a similar note, Anthony communicated the importance of having a "vision paper" that outlines the district's plans for acquiring technology and providing students with 21st century education. The approach was different from Gabriela's board however in that it was the director of education who devised the plan, not the superintendent.

> I think the best artifact I can send you is our [document]. That is our vision paper and if you read that, written by our director, it clearly tells you that for any type of initiative to happen the vision has to be solid. That is our vision and that is driving now the decisions we are making. (Anthony)

Like Gabriela and Anthony, Stan found it essential to have an accessible technology "blueprint" that guided acquisitions not only at the district level but at the

school level as well. Stan reported that both the technical (IT Department) and academic (Curriculum Department) sides of his organization devised the document.

> It is a blueprint or a guide for administrators on types of technology they should be acquiring for their schools to enable this [technology plan]. It is fully supported by IT and Curriculum. And if they deviate from that they run the risk of not having that support. And in many cases they do not. (Stan)

However, even with a very clearly laid out technology plan, Stan and Megan both outlined that in such large organizations there were going to be stakeholders that deviated from the vision.

> So of course with [several hundred] schools we are going to have the "renegades," for lack of a better term, who want to go out and try something different and new. (Stan)

Stan's department responds by evaluating the situation more closely (in trying to understand why the school decided to stray from the mandate) and by advising the administrator of the potential risks and challenges ahead.

> And in some cases we go, "Hey, that is pretty cool. Let's understand what has happened there." But in most cases it comes back and ends up causing them challenges because it is not supported or it does not quite work the way that the corporate guy said it was going to work; the teachers are not adapting to it, the students want something different. So what we try to do . . . is really enforce the benefits and advantages and importance of working with your IT and Curriculum folks in delivering a fully technology-enabled learning environment, versus the

> kind of one-offs that come in and sort of take you down a path that might look good for a couple months but ends up not being so great. (Stan)

Megan was less optimistic about getting the staff in her school district to understand the district's proposed vision. She stated that many of the teachers and administrators in her board were hesitant to change their current practices to accommodate for technology. Megan expressed that some had a very limited perspective of technology's place in education and that made getting them on board with the plan very difficult.

> Because we have a problem where I would say . . . the majority of the system does not care what the [technology plan] says. They have their own vision of how technology should be used and what technology they need. So they do not want to do it anyways. (Megan)

Contrary to the other four participants, Nicholas' district chose to adopt an external technology standard to guide acquisitions. He spoke very highly of the International Society for Technology in Education's (ISTE) standards and ranked the strategy as the primary factor for evaluating a technology prior to purchase.

> So, it all starts with strategy. We use ISTE, International Society for Technology in Education. They have 14 essential conditions for leveraging the use of technology for learning . . . . And it is also open source, it is free, and it is a worldwide community that supports it. So, you know, we feel very well supported by it. (Nicholas)

Although the standards are central to his organization's acquisition of technology, Nicholas felt comfortable deviating from guidelines he felt were not very important to his district

(in lieu of ones that were).

> So you have things like teacher professional development, sustainable funding, infrastructure. There are a number of those essential pieces that have to be in place. So we have a strategic process that identifies where gaps are and that is where we then focus our resources. So there is a process, which identifies the gaps and then also prioritizes what the most important things are. For example, one of the essential conditions is involvement of community. Well, you know, it ranks very low, low, low on our strategy, so it is not a big part. But sustainable funding is. So as we dig deeper and deeper into those, we then start to look at what components need to be funded. (Nicholas)

The presence of a technology plan/organizational vision allowed participants to create a standard that they felt best supported technology acquisition and use in their districts. Although some faced challenges in getting their stakeholders to adhere to the guidelines, many stressed the overall importance the plan had in defining their overall technology strategy.

Impact of Technology on Instruction and Student Learning

Student learning was discussed in all of the senior leader interviews. However, only three participants mentioned its prominent role in the acquisition of a new technology. Despite not being highly apparent in the data, it could not be overlooked as one of the main factors some participants considered when purchasing hardware/software. Two senior leaders placed emphasis upon the technology's ability to improve (a) pedagogy and one considered (b) student learning in their organizations when evaluating a potential acquisition (see Table 6).

Table 6

Impact of Technology on Instruction and Student Learning

Factor	Mentions
Pedagogy	2
Student learning	1

Note. Mentions refers to the number of senior leaders that cited each factor.

Pedagogy. In addition to other factors they previously mentioned, Gabriela and Anthony reported that their organizations were driven by pedagogy and not by the technology they were acquiring. Gabriela focused on supporting the needs of the teacher so that instruction throughout the school board could be both improved and adequately supported. Focusing on what the teachers' needs are allowed her department to steer clear of trends and technologies the staff did not need.

> As well, we are driven by pedagogy not by technology. So the technology is used here to support the teacher . . . . We do not go out and buy gear because it is the "equipment du jour." We go to meet the pedagogical needs of the teacher and so forth. In the order of stuff here that you are looking for, it has to meet the pedagogical needs is the primary piece in there. (Gabriela)

Anthony shared the same sentiment and highlighted that acquired technology in his school district would need to be met with *improved* instructional strategies for teachers. He acknowledged that teachers played a central role in the acquisition of technology and that without their cooperation the board would not be able to improve instruction and student learning. To Anthony, a more effective use of technology could also increase the amount of feedback the central offices received from teachers.

> Pedagogy is first. You can put in all of the technology in the world but if the type of instruction or strategies being used by teachers is not effective, it does not matter what the technology is. But if you have effective strategies, you can accelerate it. So if we know teacher feedback is important, imagine with technology how feedback can be interactive 24/7. All the time. (Anthony)

He added that the board's discussions with vendors about acquiring technology did not just revolve around the hardware/software but also improving the instructional practices of their teachers.

> So we look at a product long term with a strong partner who also wants to engage in the vision piece, not just technology, but a tool that can help the pedagogy. (Anthony)

Student learning. Nicholas and Anthony both outlined how their districts try to improve student learning through technology. For Nicholas, the ISTE standards his organization adopted give his department solid criteria from which to assess potential acquisitions. He mentioned that since the province of Ontario lacked a central curriculum or mandate around student learning and technology, the board found guidance through ISTE. The standards' emphasis on student learning aligned well with the goals of the organization, and he felt confident that the technology his board acquired would be in service of fostering things like student collaboration, creativity, and so on.

> So I think we have been with ISTE now for about five years . . . . Ontario has no computer curriculum. Whereas ISTE is really about, you know, "What are the ways that students can use technology for learning?" And they have what they call the "ISTE Strands." Six strands that, again, I don't know if you have seen them. One of them is digital citizenship, the other is computer operations. Those are really about how students use technology. But the other four about collaboration, creativity, communication, problem solving, those four are sort of, technology agnostic, but they deal with how to use technology for learning. So we saw a perfect fit with ISTE on how to integrate technology into learning. So that

> is why we chose it again in the vacuum of the province not having a curriculum. (Nicholas)

Nicholas was so pleased with the support the board received from ISTE that he even suggested other Ontario school districts consider adopting the standards.

> I highly recommend it because it really, not only hooks to this, but it hooks to what the province is doing with the "6 Cs" and everything else. They align quite nicely. (Nicholas)

Anthony reported that the tools they purchased for the learning space needed to enhance both collaboration between students (and teachers) and increase student engagement. The board set out to achieve this by decreasing their focus on servicing elementary school computer labs and instead directing their attention to devices that could be used regularly in the classroom.

> But we are trying to shift in elementary schools from computer labs and the computer model and feel the technology needs to be in the hands of kids, where teachers and students interact in the classroom every time. (Anthony)

Anthony went on to describe that his district strongly believed that collaboration amongst students and teachers did not need to be relegated to the classroom. He stated that the right technology would allow students to continue learning and sharing even when they went home.

> If we know students collaborating is an important strategy in a classroom, how about if students collaborate in the classroom but they continue to collaborate online at home and sharing through their devices? So we are trying to see how this can be accelerated with the right tool. (Anthony)

Finally, Anthony stressed that while the tool alone could create the opportunity for students to collaborate, it would be the digital content and instructional resources that engaged students in higher order learning. For his district, student engagement did not simply mean the devices garnered the attention of students and that they were being used. For Anthony, engagement amongst the district's students meant that they were using the technology to innovate, create, and learn.

> The tool itself is only as useful as the apps or the resources that are put on it. So some of the technology might even bring you . . . the caution is it might even be lower level activities that you are engaging the kids in, not the higher order thinking we are trying to get the kids to be engaged in. It might even do the opposite. (Anthony)

It is once again important to note that although several participants showed interest in addressing instruction and student learning in other portions of the interview, only a few acknowledged its importance in driving technology spending. Others focused on previously mentioned factors and smaller considerations that were not significant across the data.

Research Support

An analysis of the data revealed that the procurement of educational technology produces several challenges for senior leaders. I asked the 10 participants what resources they used to determine whether a technology was worth purchasing and if they consulted formal research to support their decision-making. Their responses were varied. Most senior leaders opted to use informal research and in-house product testing to research the merits of a technology. Furthermore, the data showed that only four participants were

using formal research to drive technology purchases in their districts. In most cases, there appeared to be a distinct separation between the IT staff and curriculum/research staff when it came to researching a technology being considered for purchase. According to the frequency in the data, fewer senior leaders consulted (a) formal research than (b) informal research when procuring technology for their districts.

Formal Research

Four senior leaders responded that they were using formal research to support technology acquisitions in their districts. Walter relied on industry research, Anthony and Amanda sought out academic scholarship, and Gabriela used a combination of both in the decision-making process.

Industry reports and white papers. Walter and Gabriela both felt industry research provided added value to the decision-making process. Although both had yet to formally enlist the services of a research firm like Gartner or Forrester, the participants revealed that they would pursue a partnership in the following academic year.

Gabriela said she tended to seek out white papers when there was an element of a technology she did not quite understand. The research report usually helped her to understand the significance of a product if its merits as an organizational solution were unclear. However, she did admit that industry reports alone were not sufficient resources on which to base an acquisition.

> We are going a little beyond just what the white papers say. I find the white papers useful if there is some piece of technology that is more than I can handle. If I really do not understand it or what the significance of these things are, I will dig the white paper out. Gartner is helpful with that as well. There are a few

> people trying to bang on my door to sell me a service as well, and I might actually take them up on it this year. (Gabriela)

In comparison, Walter felt well supported in using the services that industry research provides to frame his district's overall technology acquisitions. His previous industry experience in technology informed his position. Walter felt comfortable in knowing that firms like Gartner were highly trustworthy and "vendor agnostic." Approaching technology acquisition through this lens allowed him to be objective when making decisions and understand what separates one vendor from another.

> And then the last thing that I do is I highly value industry research . . . . And I generally go to either Gartner or Forrester and I look to them because they are vendor agnostic. They have an incredible integrity policy around how they operate that has end-to-end metrics and end-to-end validation. They basically audit themselves and they have external auditors to audit them. And throughout the last decade or so I have really come to trust them. I am a really big fan of Gartner. (Walter)

Like Gabriela, Walter felt organizations like Gartner would help him and/or his staff understand the complete impact of acquiring a particular product. While his staff was highly skilled, their ability to conduct high-level industry research paled in comparison to that of a research firm.

> Well, this is what they do for a living. They are experts at it; I am not. My people are not in general. There are some niche skill sets, but let the experts do that work. And now in 2014, there is a tremendously effective and remarkably useful online tool that they have that provides that sort of Magic Quadrant grid, which is very

> dynamic, and there are pivot tables and all kinds of wonderful things that you can drill down to what you care about as a school board or as an organization and very quickly understand how the vendors differentiate. (Walter)

Academic scholarship. Gabriela, Amanda, and Anthony all sought out various types of academic research to inform their technology decision-making. The participants either engaged researchers in their board's vision or read articles that were emerging from universities.

All three participants described the importance of working with researchers and the value that they bring to their organizations.

> It connects us to postsecondary folks like yourself doing this kind of research. It connects research back out to practice. So we get lots of those reports back out to us. (Amanda)
>
> Yeah, absolutely. It is a major thing. There is something very interesting. We very much do. We partnered up a lot with [a university in eastern Ontario]. We have an arrangement right now with [a university from central Ontario. One of the fellows up there is on a committee that we have formed up here on technology in the classroom . . . . So yes, we do that. (Gabriela)
>
> We have worked closely . . . if you look at [education researcher's] work, if you Google his work around [technology and pedagogy], we are one of the boards that are involved with his work. (Anthony)

However, Amanda communicated that although this work was important, it oftentimes did not create recommendations that were guaranteed to improve student learning. She

recognized that drawing definitive connections between technology acquisition and increased test scores might not be possible.

> The thing that it does not do good is drawing a straight line saying, "Well if you put iPads into this grade 5 class you are going to get this bump in mathematics performance" or something like that. And I do not know that you will ever . . . I think it is tough to ever draw a straight line. (Amanda)

Emerging research studies from universities were of great interest to Gabriela and Amanda. In Gabriela's case, she sought out these materials herself. She communicated the knowledge she gained from these articles to her staff by publishing a weekly newsletter. The scholarship allowed her to stay informed on educational technology and recognize patterns that would aid in the acquisition process.

> One of the little things I write is our weekly newsletter here. So in order to put an article out I need to research about 10. So it is a lot of reading. But over time things become patterns, and you need to start where there is emerging stuff coming out. (Gabriela)

In Amanda's district, she relied upon her partners in the curriculum department and her own staff to seek out newly published research from universities. Both agreed that it oftentimes was a cumbersome process.

Informal Research

Six senior leaders responded that they were using informal research to inform their acquisition of a new technology. Participants consulted numerous outside sources, and some even tested sample products internally. It was interesting to see what "research" practices senior leaders most relied upon.

Amanda mentioned that her partners in the curriculum department paid close attention to online blogs that posted about emerging classroom technology. This was a practice Walter completely disagreed with. Citing his experience in the technology industry, Walter emphasized that reviews and blogs were not trustworthy resources a senior leader should consult during the acquisition process. To him, the positive reviews and negative reviews surrounding a product essentially cancelled each other out.

> So what I try to avoid is reviews and blogs and these types of things because invariably, what most CIOs have come to understand is that most organizations that sell enterprise-grade software and hardware actually pay the shell organizations to create positive reviews. And no matter what product you are going to buy, it is going to be easy to find a positive review and it is going to be easy to find a negative review because as much as organizations pay for lobbyists or whatever to create positive content, people also get organizations or groups to create negative content about competition. And then you get the bell curve in the middle . . . . But generally I avoid all that. (Walter)

Participants commonly expressed that the technology community in the province was “tight knit” and that they often relied on their colleagues for advice/recommendations on a particular product. For Walter, communicating with other school board CIOs and IT staff was very important when acquiring technology. He acknowledged that there is a learning curve in transitioning from the private to public sectors and that engaging his colleagues was very helpful.

> The second thing I do is reach out to my colleagues. I have got a very rich network of people that I have worked with throughout the years. I have been in IT

> for over 30 years. So I will reach out to a key group of people that I know would have experience and exposure and I would say, "Hey have you implemented anything like this? What vendors have you looked at? What are your thoughts?" . . . . I am new to public sector and I am also new to education. I am building my network of school board CIOs in Ontario . . . . So reaching out to those folks is also really important because there are a lot of unique things about the way we operate in a school board that differentiates us from most private sector organizations. (Walter)

On a similar note, Daniel said that his IT staff was very connected in the broader technology community and that they were in constant contact with other school districts.

> We did not do anything formally in terms of research. All of us have connections. We have a huge IT department here that is up on all of that and is in contact with other boards to know what they are doing and considering. (Daniel)

Stan's informal research revolved around partnerships with external organizations and attending relevant educational technology events and conferences. Though his district had an active research department, they were not involved in providing resources or recommendations during the acquisition process. Instead, Stan relied on his IT and curriculum staff to weigh in on potential purchases.

> Yes, we have a research department. We have not engaged them in that capacity to specifically ask them to give us some empirical data on the difference that technology is making in the classroom. We actually do that through our curriculum partnerships. So we work with IT, curriculum, and third parties. So we will work with ISTE for example. We will attend different types of conferences

> and events, which are sometimes student driven and sometimes industry driven, to help us understand what are the more compelling technologies in the classroom for learning . . . . We do not have a formal process with our research department but our curriculum and IT folks certainly engage external to our organization in understanding the merits of technology in the classroom and specific devices. (Stan)

It should be noted that Julia also communicated that her office had not engaged the district's research department during the procurement process.

During the acquisition of a new technology, Daniel and his staff greatly relied on their own expertise to evaluate the merits of a potential classroom product. He admitted that although this process worked for his district, it was largely informal in nature.

> All of the things around the hardware. There were a bunch of samples that were brought in through the tender process. In the final decision, anyone who bid on it —we got sample products . . . . So we had various devices coming in for testing and stuff . . . . From an academic standpoint, based on the knowledge of all the people trying it, we were able to make a decision. So based on familiarity of the device, ideas of what can be done with it, I am not sure there is anything formal there. (Daniel)

Likewise, Nicholas relied on the expertise of his district's staff (teachers and administrators) and oftentimes became aware of a new technology through the board's internal innovation process. Stakeholders would fill out an innovation form requesting approval for a currently unsupported device. Once approved, Nicholas had members of his staff go to the school and evaluate its merits and use. Rather than actively seeking out

new technologies, Nicholas pays attention to what devices his teachers are using organically and then decides whether the district should centrally fund/support the product. He even explained that Google Chromebooks first came to his attention through innovation process.

> Well again I go back to the innovation process. We have [several thousand] teachers in the system. They probably have much better connections to what they have seen, what they have heard, what their friends are using in other boards, et cetera. So, we highly rely on that . . . . Certainly Chromebooks came in through that way at some great lengths. (Nicholas)

Unlike Daniel and Nicholas, Walter did not want his staff to be inundated with constantly researching and testing new technologies. In fact, he stated that it was more fiscally sound to have a research firm handle the lion's share of the workload. To Walter, time is money, and if he and his staff could avoid handling the research aspects of an acquisition, they were freed up to focus their efforts elsewhere.

> And the value of them is that for between, I've estimated between 1–3% of my total technology investment, if I invest in a membership with one of those organizations to access their content, I have created capacity for myself. Otherwise I would be spending 10–15% of my time doing research and analysis and in some cases development, bringing in machines and testing them.

Two senior leaders made little reference to supporting their districts' acquisitions through research. Megan, in particular, was highly frustrated that her colleagues in the curriculum department were unable to conduct quality research that would help in the

procurement process. To her, the academic contacts at the board were not working in partnership with the IT staff to refine the district's technology decision-making.

> We try to. The problem is we do not have much. So I am the one who is pushing our academic colleagues to really do that kind of research from their perspective because we need that. It has always puzzled me a bit that on the academic side they loathe to do really objective research and I do not understand why. I would have thought that would have been part of the education ethos, that you do objective analysis and research, but it is not. It is really more looking for information to sustain your previously established views. It is just not particularly helpful. (Megan)

Governance Procedures

One of the aims of this research study was to identify the governance procedures for technology procurement and spending in publicly funded school districts. All 10 participants possessed great knowledge of the purchasing process in their districts and described the governance models used to support decision-making. Governance Procedures is presented in three subsections. The first subsection provides information regarding the internal and external policies that govern acquisition in the school districts. The data revealed the overall formality of the boards' purchasing policies and their use in ensuring that acquisitions are transparent and accounted for. The second subsection documents the formation of committees to aid in the governance process, which includes all the actors involved in influencing technology decision-making (specifically teachers, consultants, and IT staff). The final subsection covers the senior district leadership (such

as directors of education and the board of trustees) and the vital role they play in setting policy and governing major acquisitions at the board level.

Policy

All 10 senior leaders made reference to the role policy plays in establishing guidelines for the acquisition of technology in a public sector organization. Nine participants acknowledged their obligation to abide by their district's (a) internal purchasing policies, while only five referenced the province's (b) Broader Public Sector (BPS) Procurement Directive.

Internal purchasing policies. Most of the participants recognized the importance of having/creating internal purchasing policies that outlined *their* expectations during the acquisition process. Five senior leaders spoke about the role an internal purchasing policy plays in central technology acquisitions and that they too had to abide by the rules. While there are opportunities for CIOs and superintendents to personally sign off on technology acquisitions, many choose to seek approval from their purchasing department and/or direct superiors. Gabriela gave an example of the working relationship she had with her supervisors.

> My personal signing limit is $50,000. I think that is provincial standard. That is my personal limit. But again you know as a colleague of many, I tend to not do that. I tend to bring it through my supervisors. Not the minutia, like a series of routers or something like that. If it looks like it has the capacity or potential to build out into something bigger or you know contentious things, I will bring it past my supervisor and we will talk about it that way . . . . And I suppose if I had

> to I could sign off on stuff but I try not to do that just because it is not professional. (Gabriela)

Nicholas also spoke about the risks of personally signing off on a technology acquisition. He explained that if he were to purchase a particular company's product simply because that was what *he* felt was the best decision, he would have to sign a "sole source form." This form served as a formal acknowledgement that he acquired the technology without going through a competitive bidding process and was now solely accountable for that purchase. He recognized that he could be fired pretty quickly for making an acquisition decision on his own and then not be able to rationalize it.

Given that he was new to his school district, Walter took extra care in ensuring he followed the proper protocol when making any kind of purchases on behalf of the school district.

> In terms of procurement and whatnot we do have an internal procurement policy . . . but typically because I was new to this organization when I started, any major procurement . . . not even major, anything over a couple hundred dollars or whatever, I would pick the phone up, I would call and say "Hey, we are about to do something. I want to make sure I am following the process correctly." And so there is a process that is established. (Walter)

Though he acknowledged that some senior leaders might not like having to follow a formal procedure for each potential acquisition, Walter appreciated the rigor and accountability the process provided. To him, having a policy in place ensured that acquisitions were immune from "freethinking" decisions and risky spending that was not in the best interest of the organization.

It should be noted that the school board purchasing policies most senior leaders described were not specific to technology. In fact the procurement guidelines often extended to all board acquisitions (e.g., furniture, supplies, equipment, etc.).

> We have got to go through a process of getting competitive quotes. So it is fairly rigorous from the technology standpoint but also from the purchasing standpoint that would apply to whether we are talking about technology or buying garbage bags. Anything that the board acquires, it goes through the purchasing process. (Megan)

When discussing technology spending at the school level, three senior leaders made reference to "approved" device lists/websites administrators were required to purchase from. Not only did these resources contain the names of approved suppliers, they listed all the products the board would support and/or fund at the central level.

> So if the school wanted to buy a projector, we have a standard list that they can purchase from. There are standards. (Anthony)

> Our schools also have the ability to purchase technology on our approved list of products and we might get to this about how we do our purchasing . . . . Based on what is posted on our purchasing website, a school might decide that they want to augment their existing technology portfolio or refresh a lab or a mobile cart and they would go to our purchasing site. They would choose a configuration or a "package" I'll call it for a lack of a better term, and they would contribute X amount of dollars and centrally IT would contribute the remainder. And that is our cost-sharing model. (Stan)

> What we do support and purchase then are a list of technologies. They may include mounted data projectors, laptops, desktops, Chromebooks. So we have a list of technologies that we then allow schools to purchase from with the funding that we provide. (Nicholas)

Despite having a clear mandate as to what specific technologies would be funded and supported, some participants disclosed that there had been incidents where schools deviated from their approved list. Nicholas described situations where, upon discovering that a school was not following district policy, he had the technology removed and eventually replaced. However, he recalled that although the conversation could have been contentious, he and his staff handled the situation with great care.

> So every one of those situations, you go in and you have a conversation. You do not just say "Well you have broken the rules, how dare you? We are taking it out now." It is handled very delicately. And there is a political aspect too. Like, we want our schools to have great relationships with the community. (Nicholas)

Daniel also referred to the importance of having a conversation with administrators upon discovering that a school was set to obtain technology through a parent council or donation. He stated that he preferred the acquisition be made centrally so that his team could file an RFP and procure devices (on the school's behalf) that best aligned with the overall organizational vision (and for the best possible price).

> Schools, parent councils, they are all expected to follow procurement policies. So a parent council cannot go to Best Buy and buy some computers and give them to the school. And in the cases where those happen, we try to get a hold of the conversation first before someone wants to donate. We would rather them donate

> the money where they want it to go and we will procure the products so that it matches what we already have. (Daniel)

Megan expressed real frustration when schools decided to ignore the guidelines set out by the district's purchasing policy and technology plan. She felt her academic counterparts made acquisitions based on short-term wants and were not cognizant of the long-term needs of the organization.

> And that is a real problem because schools are off doing their own thing and that is often driven by the fact that there is maybe a staff member at a school who has a particular interest in going a direction that may be near and dear to their heart. (Megan)

She believed that deviations from the central technology plan/vision at the school level were becoming increasingly common in school boards across Ontario. Megan said the main cause of this practice could be attributed to a lack of funding districts received from the Ministry of Education.

> There is a lot of discussion about a central plan but on the ground, my experience is that schools are still directing it. That is a real problem because the Ministry does not fund boards even anything close to the level that we feel it needs to acquire technology. So when that does not happen centrally, then you get schools off doing their own thing. (Megan)

Referring to the announcement that the Ministry was providing $150 million to help fund technology acquisition throughout Ontario's school districts, Megan was unsure that it would solve the problem.

> So how much actually is going to be available when you get down to the board level? We won't know yet until we see the rules and it may be spread over 3 or 5 years. So who knows at this point? (Megan)

Only one senior leader described their district's internal purchasing policies as "informal" when speaking about technology that was being purchased at the school level. Julia noted that in her district she was less concerned with what devices administrators were purchasing and more focused on building the capacity of her IT Department to support their school staff and students. Occasionally she would steer schools in a different direction and make recommendations that were in the best interest of the organization (i.e., if devices posed a security threat).

> I would say there is nothing written down because it just moves too fast. What you tend to see happen is in the schools, when they are buying stuff, they tend to buy things on an ad hoc basis. Most of the time everything goes through our purchasing department . . . . Essentially we work with the purchasing department and we say, "You know what, we really do not care about . . . like iPads, go ahead. iPods, go ahead. Android tablets, Windows devices, whatever, go ahead." (Julia)

Broader Public Sector (BPS) Procurement Directive. Five participants described the importance of ensuring the acquisition process follows the guidelines set out by the Government of Ontario. Julia reported that her district did not have a choice when it came to abiding by the rules of the directive.

> Well the formal purchasing process when it comes to devices particularly, even free stuff, is subject to that purchasing process. That is not really our choice

> necessarily. That is imposed by the government's Broader Public Sector Procurement Guidelines. (Julia)

Clive described that the main reason his organization respects the formality of the directive is because of the auditing process they undergo each year. For him, the benefit of the audit is that it allows his staff to review each acquisition and reflect on their decision-making.

> Anything that we buy has to fit into that Broader Public Sector Procurement Guidelines. The reason for that is also we do get audited every year. That process gets audited. All the POs are cut and everyone else has looked at it. "How was this approved? Who approved it? What process did they go through? Did we violate any of those processes?" All that is in place right now . . . . We follow those rules. So that is a very kind of high level, formal. (Clive)

Furthermore, he recognized that as a senior leader in a publicly funded organization, the directive was highly important in maintaining transparency and consistency throughout the procurement process.

> It is a safeguard to protect taxpayers' money and I think the auditing process is very important in the public sector. (Clive)

Four participants reported the impact the directive had on their interactions with vendors. Once a technology need had been established in their organizations, both Stan and Anthony described the RFP (request for proposal) process, in which they received competitive bids from technology vendors. The process was open and transparent. Stan explained that the RFP process allowed his team to see what technologies were available

in the marketplace and even what other districts had been purchasing for their staff and students.

> Now with the broader sector guidelines in the province in regards to the procurement process, you have to follow a formal process. So when we were an IBM board with Lenovos and we were looking at replacing that, we went through a formal process. RFP. (Anthony)
>
> The process by which we would go about acquiring that technology . . . I am going to come back to the Broader Public Sector Guidelines again. It is all done through an RFP process where first we may seek to understand what does the industry have to offer? What are other organizations doing? Whether they be learning organizations, academic organizations, or even just the private sector. Then we can get a good feel for what is actually happening out there and then through that process understand what the available technologies to support our goal are. (Stan)

Committees

Like policy, committees charged with various levels of decision-making and governance are extremely important to the procurement process according to senior leaders. In fact the data showed that anywhere from one to four different committees could be involved in a single acquisition (depending on the projected cost of the technology and/or the need being addressed). The frequency of meetings ranged from weekly to once every 4 months. In most cases the committees featured representation from both academic stakeholders (e.g., teachers, administrators, educational consultants, etc.) and business stakeholders (e.g., IT technicians, managers, accountants). Eight

participants referred to the (a) role of teachers; six mentioned the (b) role of academic consultants; and five spoke about the (c) role of IT as central components of the technology procurement process (see Table 7).

Role of teachers. Four participants described *formal* programs/roles their school district had created to engage teachers in the use, purchase, and evaluation of the technology being brought into the classroom. In contrast, four other participants reported *informal* ways teachers were driving technology decision-making (through both innovation and resistance).

One participant outlined that his board actively sought out recommendations on who influential teachers were within the district and methodically selected 60 (from both elementary and secondary schools) to hold leadership positions related to digital learning. These teachers maintained their full-time role in the classroom but were also called upon to run pilots, give feedback, and engage with the district at committee meetings.

> And these guys are all about ideas, the future. They also do a lot of their own research. These are very innovative teachers. So myself and my team also keep a close tab on that group of folks and say, "Guys, what will you need in the near future?" So when we look at those scenarios it is not about technology, it is the teachers who are making the difference. (Clive)

Similar to Clive's approach, Walter and Nicholas both had a formal process for identifying standout teachers who could help them with implementing their technology plan/vision at the school level. Both readily admitted that the program largely relied on the *technical* expertise of the teacher.

Table 7

Committee Roles

Role	Mentions
Teachers	9
Academic consultants	7
IT staff	2

Note. Mentions refers to the number of senior leaders that cited each role.

> Certainly with thousands of educators, it is difficult to get to everybody but we do have at every school a [position one]. So the principal will assign the most technologically adept teacher to be that liaison and then we work with them and it is their job to work with the other teachers. So it is kind of like train the trainer. (Walter)
>
> But probably the biggest thing we have had in place for years is someone called an [position two]. Each school has a teacher in place who really is there to be that on-site person. We try to keep away the technical pieces from them but they still end up fixing stuff. (Nicholas)

What was unique about the process in Nicholas's school board was that after the teacher had been identified, he/she became charged with planning the IT budget for the school. In collaboration with their administrator(s), these teachers were able to submit a school technology plan that directly outlined the hardware/software that was to be purchased using the funding available.

Gabriela's district sought out a different kind of expertise when selecting teachers for their teacher coach program.

> So I have a teacher coach program that has classroom teachers. I get them for 3 years in here to work with me and the schools. One of my consultants has set up this [position three] and that is a teacher per school in both elementary and secondary that is not a "techie." They are not there to hook up the boxes. They are teachers in the sense of "How do you incorporate learning technologies/assistive technologies in the classes in their schools?"

To Gabriela, this program was crucial in getting the district's ideas around technology into the schools and engaging their teachers in constructive feedback. To complement these teachers, the board also identified a technically proficient staff member at each school who would be able to provide support with hardware installation, technical problems, and so on. For Gabriela, fostering grassroots innovation in the schools was paramount.

While some senior leaders relied on these formal programs to support technology acquisition and engage teachers in the process, Daniel and Stan reported that their teachers were supporting 21st century learning on their own. Stan recounted his district's adoption of a learning management system (LMS) throughout the district and how teacher hardware/software use drove his team's decision-making.

> But we started with [LMS] and we started with [LMS] because our teachers were already there. We had a partnership with [a university], our teachers had already migrated to that, and it was a pretty telling case to IT that we should be building this internally to support them. (Stan)

Contrary to what Daniel and Stan described, Amanda and Megan sometimes encountered difficulties in engaging their teachers in the acquisition and implementation of a new technology. When it came to rolling out their recently purchased tablets, Amanda and her district made technology support/integration a *job expectation* of the board's teacher librarians. Her rationale was that the district needed a contact on the ground to support the rollout (through coaching) and to ensure that the devices were being used to support teaching and learning.

> So teacher librarians, we put it into an expectation of the job . . . . So you have young teachers who pretty much who have only done their own learning using technology to support their learning, and you have teachers that have been at the game longer that are really interested in technology, and some that are really afraid of technology. So at our board level it is "teacher librarians, you are expected do this." (Amanda)

As mentioned previously, Megan had been discouraged by the lack of engagement her academic partners had shown in working towards a sound technology vision. She expressed that some teachers and schools had become very resistant to integrating technology and that this took away from the overall goal of improving student learning.

> So you know you have that wonderful fight between the Apple crowd and the Microsoft crowd. You get all that stuff playing out. It really at some points becomes debilitating because people are losing sight of the goal. They are losing sight of the direction because they all come from their respective camps and that is what they want to achieve. Again it is often problematic because it may be one person driving it at a school level and it may be that the rest of the teachers or department heads have absolutely no interest in going in that direction whatsoever. (Megan)

Role of academic consultants. Six senior leaders made reference to the role of their district's academic consultants. Most of these individuals were former teachers or administrators who were highly involved in evaluating the technologies being considered

for purchase, training teachers, and gathering feedback/research on technology use in the classroom.

> We also have our consultants. We have five of them. They try every possible tool and they keep on coming back to the tool that is allowing kids to instantly do photo, video, access apps, and create. (Anthony)
>
> So we have those folks that are responsible to be the bridge or the glue between the technology and the pedagogy. (Walter)
>
> "Teaching and learning" have their own technology team, which used to be part of us. But now that technology team sits with the bigger teaching and learning team. It is a smaller unit of six people, but they just work with teachers around the teaching and learning related topics. But we collaborate with them on kind of a weekly basis. (Clive)

In addition to the consultants that worked on the teaching and learning side of his school district, Clive reported that the board had recently taken on 15 more consultants. After the district purchased new software focused on STEM education (curriculum promoting science, technology, engineering, and mathematics), they decided that they needed to hire experts (STEM coaches) to help with the rollout (i.e., train teachers on the product, facilitate pilot studies, etc.)

Two participants emphasized the role their board's consultants play in working with technology vendors (in addition to working with teachers and "tech coaches"). Walter spoke about the importance of one of his "pedagogical experts" who acted as a key interface between the technology companies and the school district. To Walter, this

role was essential in ensuring that the product being considered for purchase met the pedagogical and educational criteria the board had set forth.

> So anyways, what happens is we have our pedagogical expert who is, well he is not the main "tech coach" but he is the leader of the pack, so to speak. He is the one that is accountable and responsible for managing the programs and the deliverables and whatnot. So actually what he does is he is a key interface with the vendors, whether it is IBM or Microsoft or [startup company] or whatever and he goes out and does the research, works with the vendor, gets ramped up, learns the tools, learns the technologies, understands the pedagogical implementations. Then he will go out with the teachers in the schools and with the tech coaches and they will work with the teachers and really get them comfortable. (Walter)

Similarly, Nicholas discussed how the district's consultants were often charged with managing particular projects. One example he provided touched upon the creation/integration of software that organized special education data online through web forms (to complement their existing IEP engine). After engaging stakeholders from both academics and IT, a project lead was assigned (who worked with other consultants in Special Education and IT).

> And they prioritized his availability. We said, "You know, we are very clear when we have a project. If it is a priority for them, it is a priority for us. This person cannot be doing this plus everything else . . . if they want it done, they need to free up this individual in order to assist." So they did that. We assigned a project lead on our side too. (Nicholas)

The consultants worked with the vendor on the development of the software, and then the Special Education liaison assumed responsibility for the project. She trained staff, received feedback, and then further refined the product with the vendor.

Role of IT. In addition to teachers and academic consultants, decision-making committees also feature representation from IT staff. Five participants stressed the significance of involving the district's IT technicians in the acquisition of a new technology. Most senior leaders emphasized that the current role IT plays in their school districts is shifting and that the changes have created several challenges.

For many years, IT staff operated under the same guidelines day in and day out, and the acquisition of hardware/software was their responsibility *alone*. Today, most senior leaders communicated that the IT staff does not have this same level of control any longer. In fact, their role in the school district was shifting with each technology purchase being made (i.e., learning new methods of support, monitoring increasing amounts of devices, etc.).

> That is the shift where IT departments are no longer calling the shots. We are facilitating kids' learning and teachers' learning. And I think that has happened and I have seen it unfold in front of my eyes over the last six years or so. Partly because of the abundance of technology out in the field that can be easily acquired from a Future Shop environment and partly just because. (Gabriela)
>
> In the past technology decisions were being made by the IT Department. (Clive)
>
> But the role of technology acquisition, it used to be in the olden days, IT decided. IT would say "This is what you are getting. This is how you use it." It was completely locked down . . . . Our concern or scope needs to be more around

> "How do we allow for these agile device acquisitions that meet the needs of the stakeholder and not the needs of IT." (Stan)

Gabriela shared the story of when one of her colleagues in IT suddenly quit her job at another school board after becoming frustrated by all of the changes taking place. The IT manager had difficulty adjusting to the fact that her team had worked so hard over the years to create a "backed up" and "secured" environment and they were now being asked to throw that all away and "open it wide up." This example illustrates the difficult (and often overlooked) role IT has in supporting technology acquisition across a school district.

Megan felt that the emerging challenges surrounded the lack of knowledge stakeholders possessed about the work of her IT staff. One example she provided dealt with the security and privacy of the school board's network. Despite providing all of the board's staff with data on how many Internet attacks they receive each day, teachers and administrators continued to ignore policy. Megan did not know if the other stakeholders would *ever* be able to fully understand why the protocol/policies they had in place were crucial to the overall operation of the district.

> Just generally not understanding the central functions that have to occur in order for a wide area network, their LANs, their Internet access to work and their email to work every day. They think the only issue is "Well you guys just bring those boxes out and put them on our desk." Not really understanding what is behind that. That is probably not going to change for a while. (Megan)

Despite these challenges, Julia was proud of the work her IT staff was doing to meet the needs of stakeholders. She believed that one of the core values in public

education going forward was enabling staff and students to work more socially and interactively. In seeing the learning prowess of her department, Julia was confident that her department would meet any future challenges head on.

> You know I look at my IT staff as a class. I mean, they are learning every day, problem solve every day. Things are rolling out and they are trying to figure out how to do things. I think about how they learn and what the role of technology is in their learning because as much as their job is to roll out technology, technology is as much a tool that enables their learning as it is in a classroom. (Julia)

Senior District Leadership

In terms of governance, senior district leaders hold the most formal power when making technology acquisitions. The director of education, the board of trustees, and numerous managers and superintendents have important roles in drafting board-wide policy and chairing high-level committees. The data revealed that in most cases, any major technology acquisition needed to be approved by the board's senior leadership before any taxpayer money was spent. All 10 participants referred to having to seek approval for large technology acquisitions; however none had ever had a purchase request denied during their tenure.

When asked to describe a recent purchase of a new technology, Amanda chose to discuss her district's incorporation of tablets into the classroom. Once the various committees had come to an agreement that they would purchase tablets, Amanda had to report to the board's formal committee *before* approaching the board of trustees.

> So from the recommendation of choosing that, when it gets to the actual purchase, because the purchase was significantly over $100,000 . . . at that point from that

> recommendation, I write a report. I bring it to the formal committee that we have that is called the [formal committee]. And the [formal committee] is made up of the director of education and all of his senior level staff. So that includes people from finance and academic superintendents. At that point the report is looked at, tweaked if there are any concerns, and then recommended to be brought forward to the board of trustees. (Amanda)

For Gabriela, the support of the director of education and other senior leadership was crucial when lobbying the board of trustees for approval of a budget change or large acquisition.

> And if the [formal committee] here deems it a worthwhile purchase they have been pretty good about it. This year I put in for a budget increase for some classroom technology—it did not even hit the debate, it was passed. (Gabriela)

In talking with participants about their school district's budget, they revealed that no other group had as much control as the board of trustees. As publicly elected officials, their role is to ensure that taxpayer dollars are being spent wisely and that the formal policies in place are in support of improved student achievement. Both Amanda and Anthony spoke at length about the trustees' importance in approving the rollout of a new educational technology.

> Ultimately then in the governance of the school board they are the ultimate budget deciders because they are governing public money. (Amanda)

> The trustees first set high-level policy and then they set the budget. And that is when we go to approval from them. (Anthony)

Stan emphasized that although his district's trustees are ultimately focused on the dollars being spent, they also weigh in on programming decisions. He described that the trustees often pressed his staff for more information about the impact a potential technology was expected to have on student learning.

> You know we absolutely have to go to the trustees with massive acquisitions . . . . More so we focus with our trustees, definitely on dollars, absolutely. They need to be aware of what we are spending money on. But we also focus a lot with them on program and the integration of technology and program. So it is not just about, "We are going to buy 100 devices." It is about "We are going to buy 100 devices to do *this* and *this* is what we expect to see from it." They are as interested in the dollars and cents as they are in the effect it has on students. (Stan)

When it came to the contracting of a particular vendor and/or a particular brand of product, responses from senior leaders varied when discussing the role of trustees. For instance, Amanda and Gabriela communicated that after reviewing a purchase proposal, trustees often made recommendations back to their staffs to gather more information on competing products to ensure that all available options were being considered. Gabriela said that although this happened from time to time, the trustees approved almost all of the acquisition proposals they received.

> So they can make recommendations back to staff saying, "Can you bring us more information about this? Can you investigate another . . . ?" They could have recommended we investigate another device. "Can your bring back multiple recommendations on multiple devices so we can see all of them?" All of that is in

> their mandate to question and ask staff to go back and investigate that and bring the information back to them. (Amanda)
>
> The trustees will, if they decided we "missed the point" in their words, will do an amendment to the budget and include specific hardware, which they have done from time to time. Most of the time it is, I won't say rubber-stamped, but we do have a good working relationship with our trustees here. (Gabriela)

In contrast, three participants expressed that the trustees in their boards were not involved in the selection of devices. Their departments alone were able to make the call as to what technologies they were going to pursue.

> Trustees do not get involved in the "Why are we buying Dell and not buying Lenovo." Really they do not get involved at those levels. (Nicholas)
>
> No they would not be involved in the selection of devices. So we would go to them before the purchase with a plan. (Julia)
>
> But the daily acquisitions, like choosing the tablet, the trustees did not have any influence on what tablet we went with or what laptops we chose to go to as an enhancement in schools . . . . Trustees do not get involved in that. (Anthony)

Anthony went on to stress how important obtaining the board of trustees' support is when proposing a major technology acquisition. After announcing a very large investment in tablet technology, Anthony's school district began to face a number of questions around affordability, sustainability, and infrastructure. His team and many other senior leaders felt confident that they would be able to fulfill their vision, but understood that they needed the support of their local trustees.

> We did that internal assessment and then we took that to the board of trustees . . . . Because we are taking a big risk here. There are people out there that believe we will not be able to afford it, the infrastructure will not sustain it . . . . So we knew politically we needed the board of trustees to support the vision and the plan. (Anthony)

Gaining the trustees' approval avoided the possibility of encountering backlash from the local community. After all, this decision greatly impacted students and teachers. If Anthony had instructed his senior teams to pursue the purchase without involving the trustees at the onset of the project, he very well expected to receive criticism from parents and the teachers' union. However, the senior leadership and the local community rallied around the vision and ended up working together to pursue the devices.

Data Support

After analyzing the data, it was evident that the 10 Ontario school districts had governance models in place to support their acquisitions of educational technology. The participants were asked if they employed the use of data-driven decision-making, or DDDM, to support their acquisition decisions. Their responses were once again varied. Most senior leaders claimed that their organizations were data driven but had difficulty explaining what types of data they were using to support their procurement of technology. Many participants discussed their support of the concept of DDDM much more than how they were actually employing its use in their organizations. Furthermore, three participants highlighted numerous challenges associated with conducting data analysis and its overall use in the decision-making process. According to the frequency in the interviews, three senior leaders discussed DDDM as a means to (a) drive

organizational efficiency and two mentioned its ability to (b) drive student achievement (see Table 8).

All 10 participants communicated their existing knowledge on the benefits of using data-driven decision-making in an organizational capacity. Once again citing his experience working in industry, Walter spoke highly about DDDM practices and employed them in his school district frequently. To him, metrics and data were more reliable than "ad hoc" feedback when making system-wide decisions.

> So I am very metrics oriented and data driven in my decisions because from my experience, that is where the truth is buried. You can get confused and misled by making decisions based on "ad hoc" feedback because you tend to get narrow focus, siloed thinking. When you drive your decisions from data, you are working from key performance indicators and things that have been defined or that you are defining to get the best outcome . . . . Data-driven decisions are systemic across the school board and as well I am leveraging them heavily. (Walter)

Clive shared Walter's sentiments and he too made it a practice to use DDDM as a means of getting to the *true* indicators of how his large organization was performing and operating on a daily basis.

> It has a huge impact. With a board our size, because it is such a big board, the traditional way of just looking at what somebody is saying is not enough. The data always tells you different stories . . . I think the data-driven or evidence-based decision-making process has grown over the last three or four years I have seen it. It is even getting bigger because it has a huge impact on the processes that we have. It is real data. Data does not lie. (Clive)

Table 8

Uses of Data-Driven Decision-Making (DDDM)

Use	Mentions
Drive organizational efficiency	3
Drive student achievement	2

Note. Mentions refers to the number of senior leaders that cited each type of use.

Unfortunately, not all the senior leaders had success in trying to make their school districts more data-driven. While Megan discussed her board's use of data to ensure a product's technical compatibility, reliability, and so on, they were not guided by DDDM in terms of broader policy. Instead, she claimed the board was largely "emotionally driven."

> Well the answer has to be yes and no. So when we are evaluating technologies to ensure compatibility with our system, that is a data-driven exercise. If we are purchasing new software, then we are looking at the specs of the hardware. We test and evaluate that, so data drives that. So that is sort of on a small-scale technology level. In terms of broader policy, are we data driven? Sadly not. We are still, I would say, "emotionally driven" and we are trying to introduce more data-driven exercises at the policy level but it is a struggle. (Megan)

Driving Organizational Efficiency

Three participants discussed at length the application DDDM had in attempts to increase their overall organizational efficiency. Walter, Megan, and Clive all provided examples of data's role in the business operations of their school districts. The level of expertise/knowledge they communicated on the subject was impressive. In discussing the purchase and/or creation of software, Walter advocated for products that were data driven. In his district the data were being collected, but the proper outputs had not been created for his team to analyze and act on the metrics. To him, cost saving and efficiency were the results of this methodology.

> Absolutely the best type of software that you can develop is software that is data driven. What that means is you build your logic and your routines around

> executing based on data so that you are empowering the end user or the business person to be able to manipulate, manage, configure, tailor, customize the software through data so that you are not constantly at the mercy of an expensive software developer. And if you create data-driven programming, you end up saving a tremendous amount of investment in the software because it is highly configurable, highly customizable, and highly flexible. (Walter)

Though Megan was struggling to get her board to establish data-driven practices throughout the organization, her IT staff was constantly working with data on the business side. Given that she was also responsible for not only IT but the "facilities" branch of the district, she had great success in getting her planners to both log and analyze data on energy consumption, planning, enrolment, and so on.

In line with both Walter and Megan, Clive provided an example of the impact DDDM can have on a large-size organization in particular. He spoke about finding a help desk solution that eliminated the amount of resources tied up in supporting password resets from staff members. The potential for cost saving was astounding.

> Last year we had 26,000 calls come into our help desk for password resets and that is almost like 10% of the calls . . . . Each password reset is costing me $5 so that is almost $130,000 being spent on that. Can I now do something so I can lower my cost there? Now money and resources are free to do something else. It is data driven. We looked at the data. We looked at the cost and strategies saying, "Guys we need to change this so we can service our clients better and at the end of the day save money." (Clive)

Driving Student Achievement

While the benefits of DDDM seemed clear to some participants, several others expressed difficulties in using data to drive student achievement. Julia recounted the rise of data-driven decision making in Ontario in great detail and the challenge of using real-time metrics to make "on the ground" decisions in the classroom.

> Well I think 10 years ago there was a big thrust around the province around data-driven decision-making and the way that panned out was to take data that we already had like EQAO or attendance or whatever and make it available through Data Warehouse or an analytics tool type of thing. We have done that. The challenge you have with that kind of data that we have mostly got is it is a little bit like measuring a tree. So you have got a dashboard and you have someone that goes out and measures the circumference of the tree every day and lo and behold, it does not change very quickly. So it is not that useful for making these on-the-ground decisions that classrooms are having to make to tailor instruction to individual students. (Julia)

The data revealed that EQAO scores were the most common data set being used by senior leaders to justify or tailor technology acquisitions (and the resulting rollout). Daniel was weary however of relying *solely* on standardized test scores to make decisions and questioned their ability to tell you everything about a school community.

> Having had a math background, yes data is important, but I think we have to remember the people and the circumstances because data does not always tell you everything. For example, specifically EQAO results. It does not tell you

> everything about a community. There are a lot factors that play into it. So there is all types of data and not just empirical stats. (Daniel)

Stan agreed with the notion that data and test scores had their limitations. In fact, he felt some professionals get too caught up in the data and it distracts from general observations that can be dealt with more easily. Stan admitted that his board did not have a good grasp on the big data movement and questioned whether they had the capacity as an organization to take advantage of incorporating DDDM in the near future. He mentioned that he relied largely on the Ministry of Education to conduct broad studies about student achievement and that his district would respond accordingly to the province's recommendations.

> My concern is that we can become completely bogged down in data and not look at what is right in front of us. So I am a bit of a fence sitter. I think there are cases where it is obvious that the data is clear enough that you need to make this type of change . . . . Students want to bring their own device, so let them bring their own device. Tailor your delivery of instruction to personal devices instead of getting focused on what the lab might look like. That type of stuff is right there in front of us. So let's grab that low-hanging fruit without losing sight of some of the trends that we're seeing that big data is helping us to see. (Stan)

Both Nicholas and Amanda used EQAO scores in unique ways to become more data driven in their technology acquisition, deployment, and staffing. For instance, Nicholas's district used EQAO scores to identity schools that were socioeconomically disadvantaged and needed greater support (i.e., increased funding). In this situation, basic

data analysis not only drove technology deployment and funding increases, but allowed them to create equity throughout the district.

> We only use EQAO results to determine "needier" schools. Not by choice. The concept first was we wanted to provide funding to needier schools based on socioeconomic need. That is where it started. But, first of all, it is a very difficult problem to solve . . . . So we use EQAO results because EQAO results have been so strongly linked to socioeconomic factors anyways. So we have a research department in our board. We have four staff that looks after our research needs. And they were the people that recommended "This is how you should tie need into some quantifiable result." So we used EQAO. We then looked at the ranking and compared it to what our notional idea of what we thought the needier schools were and it aligned really well. (Nicholas)

Similarly, Amanda uses EQAO scores to not only determine which schools in the district need extra support (i.e., increased budget, extra staff, etc.) but also to place the most qualified math teachers in schools where they are most needed. Once again the aim of using data is to create parity within the district.

> So we regularly, when we are looking at staffing decisions, we use our demographic data, we use our EQAO, our report card data to make staffing decisions about extra staff, extra budget dollars and to some of those [equal opportunity] schools. We are even looking at teacher qualifications. It has been controversial but we are looking a bit around teacher qualification around areas like mathematics . . . . So we use data around that side at the central level to make those kind of big strategic decisions around staffing, budget allocations.

> Classroom level would be more feeding back and managing classroom level data for that day-to-day learning for the kids. (Amanda)

Assessment Measures

Another aim of this research study was to determine what kinds of assessment measures districts used to decide on the effectiveness of a technology and its impact on student learning. The 10 senior leaders made reference to a number of different testing methods they employed after acquiring a new technology. Assessment Measures is presented in two subsections. The first subsection describes the technical assessments senior leaders use to determine a product's effectiveness. The data showed that the IT staff in school districts were well versed in running diagnostic tests, measuring device usage, and so on. The second subsection describes the academic assessments districts are using to gauge technology's impact on student learning. This proved to be more challenging for senior leaders.

Technical Assessments

Seven senior leaders referred to the technical assessments they use throughout their school districts to ensure the technologies they have purchased are functioning properly and are being used by staff and students. These assessments were key indicators of whether a particular brand of technology was to be repurchased and/or how compatible the device was with the overall network. Much of the participant responses surrounded the measuring of device usage (i.e., login statistics).

Amanda found that the technical assessments her team carried out were relatively straightforward. Factors like how often a particular brand of technology needed repairing

were logged and eventually painted a picture of whether it was an isolated incident or a common occurrence in those devices.

> So on the tech side of it, it is really pretty simple because we can see uptake of use. We look at its longevity and the kinds of devices we want to use. We use our help desk system because we can see the certain kinds of breakdowns, certain products we will not use anymore, those sorts of things. So that is really, really easy tech to figure out. You know when we see lots of breaks of a particular printer brand we are not going to use that anymore. (Amanda)

Amanda was asked whether she had ever disbanded a project due to the poor performance of the devices. She revealed that since most products were purchased (in small quantities) for use in pilot projects first, they rarely "pulled the plug." However, if the feedback from the pilot study was that the technology did not adequately address the needs of the school, the district did not pursue a bigger deployment.

> So the functionality comes back reported from the end user saying, "You know what, way too complicated, I cannot do it." That kind of thing. Then we will not explore a larger rollout. (Amanda)

For Anthony, evaluating the usage of a device was the most important technical assessment his staff considered. As previously mentioned, Anthony's school district has placed great emphasis on the use of D2L and they use login statistics to verify that more and more teachers are using the portal to support instruction.

> So one of the things we are looking at is what is the percentage of teachers who are now using the tool and accessing the digital resources on D2L. So one of the things we are looking at is usage. What is the percentage of teacher usage we can

> see? We have seen an increase in teachers logging in to Desire2Learn and asking for accounts and starting to engage with kids on D2L. (Anthony)

Similarly, Nicholas also monitored his district's usage of [education software]. While he was satisfied with the growth the board was experiencing with their BYOD initiative (i.e., Wi-Fi usage), he still felt it was important to assess how the technology was improving student learning.

> We do measure a couple of things though. As of recently we are a [education software] organization so we measure usage there. In terms of "bring your own device," yes we know how many devices are on our Wi-Fi . . . . So, we know what our Wi-Fi and Internet growth has been. It has increased tenfold; we just doubled it again, so twentyfold since I have been here. We have those metrics, but in the end, how is that device helping that student learn whatever? (Nicholas)

Academic Assessments

All 10 participants expressed that their districts were experiencing difficulties in conducting high-quality academic assessments that evaluated technology's impact on their students' learning. The assessments they currently used were largely anecdotal in nature. Most of the participants' responses highlighted "pre" and "post" evaluations of EQAO test scores and student engagement measures (i.e., increased levels of attendance) during product pilots.

Both Gabriela and Stan described their difficulties in establishing reliable metrics to measure the academic value of the technologies they were acquiring. They mostly relied on anecdotal data like surveys and traditional assessments to evaluate their students.

> No, and that bugs me. We do not have metrics in place yet to assess the value of it . . . . We do have a lot of the normal assessment tools and surveys and things that we are doing with the kids but I think that needs to be made a little more robust. I am brutally honest about that . . . I call that the "Holy Grail." (Gabriela)
>
> The majority of the data is anecdotal. No doubt about it. It is really tough to measure and it is a question we get all the time. (Stan)

Megan spoke about the deployment of a recently acquired software program in her school district. Before rolling out the product to the entire system, her partners on the academic side of the district agreed to conduct several assessments and create a report on the merits of the technology. Megan said that when it came time to review the software at the end of the pilot, the report was nowhere to be found. According to her, this was a regular occurrence.

> Academics, yeah they look at it but not in any organized way . . . we did a pilot deployment of a piece of software just recently and we all had agreed in advance that we needed to evaluate this before we did a system rollout and everybody was onboard. "Yes that is great, we are going to do that." And then the end of the pilot came and we are looking for the report . . . well there is no report. "We had a couple guys look at it but we are really not sure." And I hate to cherry pick but that is not really cherry picking, that is more often than not what tends to happen . . . . They are really not comfortable with how to actually go about doing research other than going around and asking three people, "Gee, do you like it?" (Megan)

Given the difficulties they were having in establishing reliable metrics around technology and student achievement, many senior leaders opted to consult EQAO scores.

However, most participants reported that they did not play a large role in the acquisition of a new technology; it was simply one of the only metrics they had available. Several reasons were presented for EQAO's small use in evaluating technology's impact on student learning.

Megan and Clive both highlighted that for every example where technology seemed to improve standardized test scores, there was another example where no improvements were documented.

> And I am glad you mentioned EQAO. I was just going to say that we have no evidence whatsoever that those schools that have been leaders in the deployment of technology have experienced any impact in their EQAO results. (Megan)
>
> I have seen schools with good technology in place but having low numbers show up in their reading and writing results and other things. I have seen schools with very poor technology but are having better results when it comes to EQAO numbers. (Clive)

Daniel believed that tying technology and student achievement together was an ill-conceived idea. In his district they did not believe that technology was anything more than an "add-on" and that it would not be possible to create measurements that accurately showed you its value in EQAO performance.

> In terms of actual improvement in scores, we have really stayed away from that whole idea because our belief is that the technology is sort of an add-on and you will never be able to narrow it down to say it was the addition of technology that improved scores or did not. (Daniel)

While they did pay attention to EQAO scores, Amanda and Anthony both cited the use of report card grades as an academic assessment they often referred to. However, even report card grades did not capture the total impact of a newly acquired technology. Amanda reported that while report card grades reflected the internal performance of the district, they relied on EQAO grades to provide "external validation" that their students were on par with the rest of the province.

> On the academic side of things it is much softer. So EQAO is used quite a bit as an external indicator. We use report card grades quite a bit. The problem with report card grades are they are a bit internal. You do not have that external validation that we get from the provincial testing. (Amanda)

On the other hand, Anthony felt report card grades were a more accurate assessment of student learning and its relation to technology. He expressed that the issue with EQAO testing is that it is a "paper and pencil" task. Anthony said that the type of learning his school district was trying to foster did not necessarily align perfectly with the learning EQAO was trying to evaluate.

> I do not want to go through every little piece but the hardest piece we are struggling with is the public accountability; people are going to hope that the EQAO test scores in these schools demonstrate an increase in learning. One of the challenges may be how we are asking kids to demonstrate their learning with the tool and it might not be as aligned with EQAO considering it is a paper and pencil task that demonstrates their learning. So we know we have to look at report card data. We expect a change around report card data. (Anthony)

In surmising that they would not be able to tie student achievement to technology through hard evidence, Stan and Julia often considered softer assessment measures that would more accurately demonstrate a device's impact in the classroom.

> The data is available to me, but I do not base my technology acquisition decisions based on whether that school's EQAO scores are low or high. If we are going to do something special in a school, a lot of it is driven by the leadership in the school. (Stan)

> The challenge is that where technology is concerned, you always have an intuitive sense that this is going to benefit somehow, but there is not a lot of hard, empirical evidence to say, "In this specific instance it dramatically improved outcomes in student learning" . . . but I will be gathering some data on participation rates and those kinds of things. (Julia)

Student engagement rates were the most frequently mentioned measure cited by the 10 senior leaders. Most participants discussed using these assessment measures with groups that were disadvantaged (i.e., schools in low socioeconomic regions, Special Education classrooms, etc.). Gabriela saw the instant impact tablets had on her district's Special Education classrooms. While she was not able to tell if it would improve their students' formal grades, she noticed a drastic shift in their engagement and participation.

> We are seeing a lot of interesting stuff though with the tablets and where the kids could not write properly, they can use it as a representation of their work. While I do not know if it would improve their marks or their scores, it certainly improves their participation in class, whereas they would not do it all. In participating, it would affect or give them a leg up. (Gabriela)

Amanda described the similar effect a 1:1 deployment project had on a classroom in one of the district's "equal opportunity" schools.

> We also believe tech is a student engagement device as well and we surmise that it has an impact that makes kids kind of want to be there. So we look a bit at attendance and see if attendance is impacted, especially where we have done maybe a more 1:1 classroom in some of our lower socioeconomic schools or those [equal opportunity] schools. (Amanda)

Finally, Stan discussed numerous strategies his district had employed to measure technology's impact on the classroom. In the areas of reading and writing, Stan and his academic counterparts created "literacy circles" that provided struggling students with devices and worked with them in different ways using the tools (e.g., collaboration with peers, writing with the device itself, etc.). After continuously monitoring the student's development, the staff would conduct a posttest three months later and see if the student had improved in a few targeted areas and was more engaged in the subject matter. Stan stressed that engagement, though often seen as a soft measure, was a key indicator of technology's impact on learning in their district.

> I mean some hard evidence, for what it is worth, is in classrooms where technology is actively engaged in learning, we have great attendance. They are there! I mean it is kind of interesting that kids will show up if it is engaging and meaningful. (Stan)

Return on Investment

Participants were asked how they reported the return on educational technology investments or "ROI" within their school districts and communities. While many senior leaders reported back to the board of trustees to update them on the progress of various

technology deployments, none had a formal ROI process in place. In fact, some senior leaders communicated that such a calculation would be incredibly hard to quantify. Once again *softer* reports with limited data were used to justify their technology acquisitions.

Clive readily admitted that his school district did not have a formal process for conducting ROI analysis. In most cases, progress updates were conducted every 6 months or year.

> We do not have a formal process for each project to do ROI analysis. That does not exist. It is one of those things that is nice to have after every project. You do an ROI analysis after 6 months or a year saying where we are. For that, we do not have a formal process. (Clive)

Nicholas expressed the immense difficulty in being able to conduct an accurate ROI analysis in his school district. He pointed to the fact that while his school board was notorious for having excellent EQAO test results, that did not necessarily mean that technology was making the difference.

> How do you quantify it right? . . . So as we have said there are not a lot of ROI tools. And again, the director of education said . . . , "How do I know that technology is improving instruction?" How do I know anything is improving instruction? Whether it is improved lighting, air conditioning. (Nicholas)

Megan understood the value of being able to report back on the return the district received on an investment in classroom technology. Currently her team is responsible for reporting to the board of trustees only on what they spent compared to what was originally budgeted. She said that she has tried incessantly to get her colleagues to realize the importance of maximizing the board's limited resources. However, when it came time

to review the data they collected and use it to inform their decision-making, most staff members did not want to listen.

> Really the only check on that is the overall budget where we have our expenditures relative to what was budgeted each year . . . . Because when you have limited resources, you should be allocating to get the biggest ROI. I mean that is what we want to do. So go into it knowing we cannot do everything, let's apply it to where we are going to get the biggest bang for our buck. Everyone agrees in theory. But when you sit down and say, "Okay, well here is what the data says as to how that should be deployed," that doesn't comply with their previously held views on how it should happen. (Megan)

Shifting from trying to report financial returns on technology investments, Amanda and Julia most often relied on softer reports. When asked to appear before the board of trustees and update them on the status of a recent technology deployment, Amanda chose to highlight teachers' observations of increased student engagement in the classroom.

> I do not have a way of saying, "Yeah, for sure this made a huge difference in our EQAO scores," or "Our kids' report card grades shot through the roof" . . . . We can only go on the softer reports from our teachers saying, "Kids are really engaged with the devices they are using, the device is regularly in use, we use it to both consume and create knowledge." So we get those softer reports. But can I say it was better than a kid sitting with a pen and paper and a textbook? I cannot. (Amanda)

Julia admitted that in the past, ROI simply referred to the fact that people enjoyed having the technology at their disposal (regardless of whether it was being used or thoughtfully integrated into learning and instruction). Today, she pointed to the district's increased Internet usage to justify the investments.

> So ROI in the past has really been all about I give someone an iPad and they are happy and they want an iPad. That was kind of the payoff. But to an increasing extent it is becoming important to demonstrate that at the very least when I put something in, did people use it? As a really simple measure . . . if you look at a decent proxy measure for technology usage across the board, you just look at the saturation of our Internet productivity. You know over the course of the last 10 years we have increased our Internet productivity by 50 times. (Julia)

One of the most in-depth answers came from Stan. He discussed that in a large organization, such as his school district, the best returns on technology investments were ones that increased capacity in *both* academics and business.

> I think as a CIO there is a responsibility that we report back on how our investment is serving the organization. We have already talked about how difficult it is to establish the return on the learning investment other than certainly student engagement and teacher feedback. But the perfect, ideal situation is when you implement a technology that is all encompassing enough that it is not just a learning investment return; there is a business return also. (Stan)

He revisited the example of increasing the robustness of the wireless infrastructure of the school board. In addition to providing students with a strong Wi-Fi connection to support BYOD, they were now able to facilitate comprehensive video conferencing for their staff

as well (which produced financial savings). Similarly, the investment in a district-wide VoIP (Voice over IP) solution saved their schools thousands of dollars with respect to long distance charges.

When Anthony and other senior-level staff approached the board of trustees with their technology plan, the trustees made it very clear that they did not have additional funding to support the vision. He and his staff were asked to repurpose dollars. Anthony's team responded by no longer funding the outfitting and support of computer labs in particular schools involved with their pilot project. While they received pushback from school and parent councils, they knew that once the devices they had purchased/leased were in the hands of kids, stakeholders would come around.

> I mean the return on investment; one of the things we have to show the board of trustees is that we were investing in technology for the last 10–15 years. We were. Outside what we were providing schools with the computer labs with a 10:1 ratio and printers, schools were still making purchases at Best Buy and some discount places. They were spending a lot of money. What we need to demonstrate to them is that we are repurposing dollars. (Anthony)

However, this was not the only ROI measure the trustees were asking for. In fact, Anthony described the board of trustees as results oriented and less concerned about the overall learning that was taking place throughout the school district.

> The other return on investment is improved student achievement. From a board of trustees' perception, it is graduation rates and EQAO. Although we talked about knowing your students, knowing them at such an intimate level, their learning needs, that is not what gets shared in the boardroom. (Anthony)

Chapter Summary

The most important factors driving technology acquisition were first discussed in this section. The most frequent responses from senior leaders were (1) cost-related factors; (2) impact on school board infrastructure; (3) product specifications; (4) alignment with technology plan/organizational vision; and (5) the impact of technology on instruction and student learning. Furthermore, participants' use of formal and informal research in the decision-making process was presented. Following discussion of the most important considerations and research support, the governance of technology acquisition was described. Senior leaders' varied uses of data-driven exercises were subsequently addressed. Last, the assessment measures and ROI calculations school districts employ to justify their spending were highlighted.

CHAPTER FIVE: DISCUSSION, IMPLICATIONS, AND CONCLUSIONS

"It's more fun to arrive at a conclusion than to justify it." – Malcolm Forbes (Booher, 2001, p. 77).

This study focused on the decision-making process behind technology acquisition in Ontario's publicly funded school districts. A semistructured interview that contained qualitative, open-ended questions (and some closed-ended questions) was developed based on the literature. Case study methodology was used in order to ensure the study's 10 disparate school boards and leaders could be organizationally linked by context. This research stemmed from both the lack of high-quality research that examines educational technology procurement and the danger uninformed acquisition poses to school districts and their stakeholders (i.e., wasted funds, loss of public trust, etc.). To gain an understanding of the research that was conducted, a summary of the study, discussion of the findings, the study's limitations, and an examination of the implications of the results are presented in this chapter.

Discussion

In this section the findings are interpreted and examined to understand how Ontario's publicly funded school districts make decisions on acquiring new technology for their school systems. This is assessed according to the research questions and then compared to the data uncovered through the literature review.

Most Important Factors and Research Support

Discussion in this section outlines the most important factors driving technology acquisition that were presented in Chapter Four. Analysis of the interview data revealed that (1) cost-related factors; (2) impact on school board infrastructure; (3) product

specifications; (4) technology plan/organizational vision and (5) impact on instruction and student learning are the primary factors driving technology acquisition. Furthermore, it was determined that most senior leaders are not using formal research (i.e., academic scholarship) to inform their decision-making.

Cost-related factors. The findings revealed that *cost-related factors* are the most important concerns senior leaders have when acquiring a new technology for their school district. While the importance of financial considerations is echoed throughout the literature (Boser, 2013; Cuban, 2001; Greaves & Hayes, 2008; Magolda, 2006; Morrison et al., 2014; Sundeen & Sundeen, 2013), they should not be *driving* technology acquisition. These findings contradict what Fullan (2013a) calls for in his Ontario Ministry of Education report, *Great to Excellent*. While he highlights that Ontario has differentiated itself from educational systems around the world by not focusing on *acquisition* and refusing to make large investments in technology, this was not a discernable practice in the 10 participating school boards. Despite emphasizing that Ontario should now focus on *pedagogy* as the driver behind the acquisition and integration of ICT, it seems that cost-related factors like price/affordability, sustainability, and cost-saving potential are the drivers, according to this study's findings.

The cost-saving benefits of technology integration have been well covered in recent scholarship (Finkel, 2012; Gomes, 2011; Greaves & Hayes, 2008; Hastings, 2009). However, where this study extends beyond what is known in the literature is that the adoption of inexpensive/free technologies also brings with it numerous challenges (many of which are *costly*). In fact, most participants highlighted experiences where a rather inexpensive technology acquisition resulted in additional (and sometimes unexpected)

costs. From the analysis of the data, this study concludes that the *risks* associated with acquiring technology for cost-saving purposes need to be highlighted in the scholarship.

While the attention senior leaders place on cost may be excessive, it is a subject of which all 10 participants had a very robust knowledge. As highlighted in this study's conceptual framework, efficacious funding (Boser, 2013; Cuban, 2001; Greaves & Hayes, 2008; ISTE, 2009; Magolda, 2006; Sundeen & Sundeen, 2013) and total cost of ownership (Greaves & Hayes, 2008; Krueger, 2013) should be key considerations during the procurement process, and this was evident in the findings. For example, when talking about sustainability, Megan stated that despite having a plan in place for the acquisition of a new technology, her district would hold off until the funding had been secured.

> I think when we can get the funding in place for our plan, I think it is going to work well because I think we are heading in the right direction (Megan).

Similarly, Julia's district made sure to evaluate the associated costs incurred before acquiring a new technology and how this practice applied not only to centralized purchases but to individual school purchases as well.

> Is it useful to the rest of the organization? Can I scale it? Can I learn from it? Is it going to help somebody out? So really if it is all just about, you know, a demonstration product that I cannot fully scale or cannot sustain, then we are probably going to advise the school against it. (Julia)

This finding also echoes the results of very recent research that has emerged within the last few months. Morrison et al.'s (2014) study focused on ed-tech purchasing in K–12 schools in the U.S. and was comprised of both interviews and surveys of senior leaders and technology providers. They write, "The most frequent challenge expressed in

open-ended survey responses, and most strongly emphasized by superintendents, related to funding and financial concerns. District participants referenced the cost of items, as well as reductions in the technology budgets for school districts" (Morrison et al., 2014, p. 5). This heavy focus on spending was also prevalent in the Bill and Melinda Gates Foundation (2014) study, *Teachers Know Best*. After analyzing the procurement habits of 16 school districts in the United States, the organization concluded,

> Across the country, districts are spending inconsistently as they seek new solutions to meet student and teacher needs. They are purchasing many different products; for example, the 16 districts examined in this study collectively purchased more than 183 different products. This figure does not include any free products, products teachers purchased with their own funds, or products teachers purchased with other outside funds. (Bill and Melinda Gates Foundation, 2014, p. 24)

Consequently, this study reinforces the notion that financial concerns weigh heavily on senior leaders during the acquisition of technology for their school districts.

Impact on school board infrastructure. The finding that a technology's *impact on school board infrastructure* is a key factor in senior leaders' decision-making is somewhat consistent with the limited literature on technology spending and acquisition. Five senior leaders highlighted that infrastructure-related concerns were the most important considerations they accounted for and emphasized access/mobility and compatibility with the district's existing network in particular. For the procurement of a new technology to be effective, several studies mention that the proper infrastructure needs to be in place in order for the district to support the device/software and deliver

services to stakeholders (Gray et al., 2010; Greaves & Hayes, 2008; ISTE, 2009). However, it should be noted that infrastructure concerns appeared to be far more important to this study's participants (and far more frequent in the data) when compared to other studies. The Greaves and Hayes (2008) study shows that despite the fact that infrastructure and wireless networks are largely outdated in U.S. districts, many senior leaders were running successful 1:1 implementations (with few challenges) and were equally focused on financial concerns, professional development, online assessment, and a number of other factors.

The ISTE (2009) guidelines identify that both *implementation planning* and *equitable access* are essential conditions for sound technology decision-making, and the findings are analogous to this. The findings of this study revealed that most of the participants were ensuring their organizations were taking steps to confirm that the infrastructure in place would support the new technologies being brought into the learning environment. Prior to rolling out their BYOD policy, Julia's district made significant improvements to the wireless network to support stakeholder device use.

> Put in about 500 wireless access points so we had 100% coverage because we thought it would be kind of stupid to put one AP in a school and kids would have to sit in a corner of the library if they wanted to use the Wi-Fi. So that was what prompted us to say, "We are going everywhere." (Julia)

Julia's response highlights how her district attempted to avoid costly mistakes like insufficient Wi-Fi and bandwidth connectivity during the procurement process (Gray et al., 2010, Greaves & Hayes, 2008). As a result, ITSE's (2009) guidelines and this study's findings place similar emphasis on infrastructure, planning, and access.

Product specifications. The finding that *product specifications* weigh heavily in participants' acquisition decisions is not explicitly noted in the literature. This finding is important as it once again confirms that senior leaders are very adept at the *purchasing* and central management of software/hardware. The participants considered product specifications like durability, functionality, and assistive features when evaluating a new product. The only connection to student learning came from three senior leaders who accounted for their districts' Special Education students when making a technology acquisition.

When describing the most costly mistakes associated with technology procurement, Greaves and Hayes (2008), Johnson and Maddux (2008), and Krueger (2013) cite hardware and software problems as one of the most frequent occurrences in American school districts. The participating school leaders seemed to recognize this and are taking proactive, evaluative measures to ensure they are receiving the best financial return on their purchases (i.e., increased shelf life, increased usage, limited repair costs, etc.). However, this heavy focus on product specifications only further extends the notion that district leaders are squandering opportunities to make real connections between technology and learning. Fullan (2013b) writes,

> even the most sophisticated technology still needs to be guided by some pedagogy. In this respect even the vaunted iPad doesn't measure up. Orrin Murray and Nicole Olcese review the iPad from a teaching and learning perspective. They conclude that technological companies and leading policy makers are seduced by the apparent power of ever innovating technological products. To get a PDA (personal digital assistant) in every child's hand seems so evidently desirable.

> Another silver bullet wasted if you don't concentrate on best pedagogy. (pp. 58–59)

The participants' focus on product specifications confirms that districts place greater importance on the technology itself rather than the hardware/software's impact on instruction and student learning.

Technology plan/organizational vision. The finding that a technology's alignment with the district's *technology plan/organizational vision* is important to some decision-makers is somewhat consistent with the reviewed literature. Only half of the participants made reference to the existence of a system-wide vision that had been communicated to stakeholders and was being used to guide current/future technology acquisitions. Central to the conceptual framework of this research is an understanding that organizational vision is *essential* to sound technology decision-making and leadership (Fullan, 2013b; Gomes, 2011; Hall, 2010; ISTE, 2009). While some participants recognized the importance of a technology plan, none noted that the overall vision had been informed by the *entire* organization. In fact, very little mention was made of stakeholders directly informing the district's overall technology strategy in the interviews. Two senior leaders cited that they engaged students once a year through either a survey or forum while others made broad reference to "consultations" they had with stakeholders on an ad hoc basis. This is not aligned with the relevant research. ISTE (2009) places great emphasis on the importance of creating a "shared vision." They implore senior leaders to utilize, "proactive leadership in developing a shared vision for educational technology among all education stakeholders, including teachers and support staff, school and district administrators, teacher educators, students, parents, and the

community" (ISTE, 2009, para. 1). Perhaps the absence of this meaningful engagement is why some leaders are having difficulty getting their teachers and administrators to buy in to their technology plans/policies. Megan expressed extreme difficulty in getting her academic counterparts to work with the board's IT staff to create a sound learning environment empowered by technology. The absence of a common long-term goal/vision (that was *shared*) was becoming debilitating.

> But that is going to be an ongoing struggle because there are different foci that each of us have and that is probably never going to change because the academic folks come to it from a very different perspective. They are very school focused because they were principals at one point and before that they were teachers, so they are really sort of thinking about satisfying that immediate need. (Megan)

While the findings indicated that some participants recognized the importance of having a technology plan/organizational vision, challenges emerged in other districts where a shared vision was absent.

Impact on instruction and student learning. An emphasis and focus on technology's *impact on instruction and student learning* during acquisition is strikingly limited in the data collected from senior leaders. The findings indicated that only two senior leaders place importance upon a technology's ability to improve pedagogy and only one considers student learning as an important factor during acquisition. This is highly inconsistent with the current literature on supporting student learning through technology and this study's conceptual framework. When asked what their most important considerations were during the procurement process, participants largely overlooked the key elements of student engagement (APA Work Group of the Board of

Educational Affairs, 1997; Finkel, 2012; Marzano et al., 2001), collaboration (APA Work Group of the Board of Educational Affairs, 1997; Marzano et al., 2010), and teacher training (Avidov-Ungar & Eshet-Alkakay, 2011; Blow & McConnell, 2012; Culp et al., 2005; Finkel, 2012; Greaves & Hayes, 2008; Hall, 2010; ISTE, 2009; Johnson & Maddux, 2008; Spector, 2013). Without a focus on pedagogy and student learning, school leaders and their districts risk being exposed to numerous challenges (e.g., poor adoption rates, wasted funds, etc.; Fullan, 2013b). Militello and Friend (2013) discuss the important role senior leaders play in establishing pedagogically driven acquisition. They rationalize that sound leadership practices can allow district leaders to transform technology into good pedagogy that has a positive impact on student learning.

One reason instruction and student learning considerations may be overlooked during procurement is due to senior leaders' awareness of the lack of empirical evidence that supports technology integration as a means of improving student achievement (Bebell et al., 2010; Jenkinson, 2009; Johnson & Maddux, 2008).

> There is one other big overarching problem that nobody talks about. And I am not sure if you have come across this or not, and you may have more information than I do from your research, but there is little, if any, pedagogical evidence that technology in the classroom helps learning and achievement. (Megan)

However, with the wealth of research that supports technology as a means of fostering critical 21st century skills (Clarke et al., 2014; Krueger, 2013; The Partnership for 21st Century Skills, 2011), senior leaders need to adjust their approach to focus on improving student learning (more broadly) and not simply hone in on measured increases in EQAO scores and report card grades.

Despite being heavily referenced in the research as an essential consideration for senior leaders during technology procurement (Blow & McConnell, 2012; Culp et al., 2005; Finkel, 2013; Greaves & Hayes, 2008; Hall, 2010; Johnson & Maddux, 2008; Spector, 2013), teacher training was mentioned sparingly across all 10 interviews, and only two senior leaders identified it as important. Avidov-Ungar and Eshet-Alkakay's (2011) study on teachers' knowledge and attitudes during technology implementation highlights

> the pivotal role of the co-existence of a learning organizational culture in school, side by side with a high level of teachers' technological-content-pedagogical knowledge, in generating positive attitudes towards the changes that innovative technologies bring and in improving the implementation's success. (p. 300)

Without meaningful and relevant professional development being a key consideration for senior leaders during the decision-making process, teachers will struggle with incorporating 21st century technologies and learning strategies into the classroom. Furthermore, the literature stresses that inadequate or incorrect professional development has been one of the most common errors in technology decision-making and often results in wasted funds for districts and their stakeholders (Cuban, 2001; Finkel, 2012; Greaves & Hayes, 2008; Spector, 2013).

Research. Larry Cuban (2001) has long promoted the importance of conducting and reviewing research that examines the impact of technology on teachers and students prior to its being implemented in the classroom. An analysis of the data revealed that the most important factors senior leaders consider with each potential technology acquisition are *not* supported by the relevant literature. This is further verified by the finding that

most senior leaders rely on informal *research* to guide their decision-making. As mentioned previously, senior leaders struggle with their organization's ability to draw concrete connections from formal scholarship and extend them into practice. Perhaps this is why curriculum and IT staff rely largely on education blogs, personal experience, recommendations from colleagues, and so on to inform their acquisitions. It should be noted that none of the senior leaders engaged their district's Research Department during the acquisition process.

Where this study extends beyond what is known in the literature is that two of the four senior leaders using formal research were in fact using *industry* reports/tools to guide their decision-making. While the white papers they used were technical in nature (and contained no academic information about student learning), these district leaders felt better supported in the purchasing process by using a professional research firm that specialized in market research, vendor ratings, and strategic technology planning. If the use of these services allows senior leaders to feel more comfortable in evaluating the cost and infrastructure-related factors of a potential technology acquisition, then perhaps they would be able to place a greater focus on instruction and student learning. From the analysis of the data, this study concludes that the use of industry research should be added to the literature on technology spending and procurement. More important, this study's conceptual framework highlights that senior leaders need to use formal scholarship to guide their decision-making.

Governance and Data Support

Discussion in this section outlines the governance procedures for technology procurement and spending that were presented in Chapter Four. Analysis of the interview

data uncovered that policy, committees, and senior district leadership play important roles in the governance models used to support technology acquisition. Moreover, it was determined that while senior leaders and their districts are making varied (and inconsistent) uses of data in their organizations, most struggled to use data in meaningful ways (i.e., to support spending, to make in-class decisions, etc.).

Policy. Supportive policies related to technology are imperative to successful acquisition and implementation (ISTE, 2009; Leithwood, 2012). The finding that *policy* plays an important role in governing the acquisition of technology in publicly funded school districts is somewhat consistent with the reviewed literature. While most of the scholarship dealing with technology policy focuses on stakeholder usage (i.e., guidelines surrounding privacy, BYOD, acceptable use, etc.), some connections can be made to acquisition.

The data revealed that senior leaders rely heavily on very formal internal and external purchasing policies (i.e., Broader Public Sector [BPS] Procurement Directive) during the purchasing process.

> Anything that we buy has to fit into that Broader Public Sector Procurement Guidelines. The reason for that is also we do get audited every year. That process gets audited. All the POs are cut and everyone else has looked at it. "How was this approved? Who approved it? What process did they go through? Did we violate any of those processes?" All that is in place right now . . . . We follow those rules. So that is a very kind of high level, formal. (Clive)

Though a rigorous acquisition process is common (and required) for *any* kind of purchase within a public sector organization, districts should be adjusting their policies to better

reflect the essential conditions for effective ICT implementation (ISTE, 2009). In fact, only three senior leaders referenced purchasing policies that were specific to classroom technology. Culp et al. (2005) assert that the reason for this may be due to the fact that technologies are evolving much faster than districts are able to amend their current practices and purchasing plans.

Where the findings deviate from the limited scholarship on technology acquisition policy is in the senior leaders' focus on centralized procurement. The interview data revealed that while individual schools have the ability to purchase technology from their own budgets, the majority of the spending takes place at the district level. While this is understandable given the large size of the school boards and their hyper focus on cost-related factors, Maas and Lake (2015) advocate for more decentralized procurement strategies. After analyzing educational technology acquisitions in six large urban school districts in the U.S., Mass and Lake stated,

> Given these trade-offs, school districts should determine an appropriate mix of centralized and decentralized procurement strategies based on their needs and capacities. It may be tempting to try to realize cost savings and benefits that come with centralized procurement. And some degree of centralization is likely necessary to ensure that systems are compatible or that, when necessary, they meet some universal needs (e.g., Common Core implementation). But the need for flexibility, procurer discretion, and dynamic systems in fast-paced contexts often favors a more decentralized structure. Decentralization may also help match product options with a wide variety of end-users' needs and openness to adopt new products. (p. 9)

Once again it seems the approaches (and challenges) to procuring educational technology for large size school districts was not noticeably different in the findings when compared to other educational systems around the world.

Committees. The findings revealed that *committees* also largely contributed to the governance of educational technology acquisition and implementation in the participating school districts. Senior leaders mentioned that in addition to senior district leadership, teachers, academic consultants, and IT staff are all integral parts of the decision-making process. It was apparent that all of the districts are in a significant period of transition and have recently undergone changes to better address the technology needs in their organization. This is consistent with recent research emerging from Ontario. Clarke et al. (2014) write,

> School districts are investigating and implementing new organizational structures that embed coordinated approaches to using technology. They are in the early stages of aligning departments and jurisdictional responsibilities to enable system-wide approaches to 21st century teaching and learning (e.g., establishing working relationships between IT and curriculum, involving personnel at multiple levels within and across school systems). (p. 19)

Anthony described how a large technology rollout within his district forced them to reevaluate their current committees and decision-making process.

> We intentionally said that the [IT] world needs to work hand in hand with our [academic] world. And they need to understand when IT makes a decision, how it impacts program or when the program people are making a decision based on innovation, can the IT world support that standard or not. (Anthony)

It should be noted that the inclusion (and importance) of academic consultants and IT staff on governing committees is emergent in the interview data but largely absent in the formal literature.

While most of the senior leaders mentioned the key roles teachers play on certain committees or in the rollout/implementation process, only one discussed their direct involvement in the acquisition of a new technology. As mentioned previously, this contradicts the reviewed literature that says if teachers are given a greater voice in the decision-making process, the success rate of the technology implementation greatly increases (Bill and Melinda Gates Foundation, 2014). Clive's district was the only one that used a formal committee group of elite teachers to drive technology procurement and actively sought recommendations from them throughout the year.

> They say, "Clive, this is a good technology. It is easy to use. We should look at it." When they come and tell us that we assess it in how it is going to work with us. We look at the funding model too. (Clive)

The overall lack of teacher engagement in the acquisition process is well documented in the recent scholarship (Bill and Melinda Gates Foundation, 2014; Digital Promise & Education Industry Association, 2014; Maas & Lake, 2015; Morrison et al., 2014). More concerted efforts need to be made to involve teachers (of varied comfort levels with technology) in *meaningful* ways during the acquisition process. The Bill and Melinda Gates Foundation (2014) study makes the value proposition clear: "Teachers don't get to choose many of the products their students use, but when they are given the opportunity to select them, they are more likely to report that products were effective" (p. 3).

Though classroom teachers may not be involved extensively in procurement, their role in technology implementation is aligned with the reviewed literature. The creation of positions like "tech coaches" or increasing the leadership responsibilities of teacher librarians is evident in Johnston's (2011) research and deemed integral to effective technology integration. An analysis of the data revealed that teachers across the 10 participating districts were largely being utilized in this context when compared to procurement (where they are used sparingly).

Senior district leadership. The finding that *senior district leadership* (i.e., CIOs, superintendents, directors of education, boards of trustees, etc.) has an important role in the districts' governance of technology procurement is consistent with the limited literature on the subject (Fullan, 2013b; ISTE, 2009; Leithwood, 2012). Senior leaders outlined their trustees' particular emphasis on setting high-level policy.

> The trustees first set high-level policy and then they set the budget. And that is when we go to approval from them. (Anthony)

This emphasis was also echoed by Leithwood (2012) in his study of strong districts in Ontario and their leadership. He writes,

> Growth in student achievement and well-being is encouraged when elected boards of trustees focus most of their attention on board policy and concern themselves with ensuring the district mission and vision drive the district's improvement efforts. (p. 19)

However, responses that outlined trustees' interests in student learning and well-being were varied. Some participants claimed that trustees mainly weighed in on policy, budgeting, and EQAO scores, while others claimed they were very involved in assessing

how their district could improve student learning (more broadly). Though trustees hold the most formal power in the governance of technology acquisition, their involvement was quite limited when compared to the senior leaders and their respective departments, teams, and committees.

DDDM. The relevant literature included in this study's conceptual framework indicates that timeliness (Greaves & Hayes, 2008; Ikemoto & Marsh, 2007; Mandinach et al., 2006), accessibility (Ikemoto & Marsh, 2007; Mandinach et al., 2006; Ministry of Education, Ontario, 2011), and capacity (Gomes, 2011; Ikemoto & Marsh, 2007; Mandinach & Honey, 2008; Mandinach et al., 2006) are all key factors associated with data use in technology decision-making. These considerations were largely ignored by participants when asked if their organizations employed the use of data-driven decision-making (*DDDM*). An analysis of the data revealed that the governance procedures for technology procurement and spending are *not* supported by DDDM. In fact, some senior leaders were conflicted about the role data should play in technology acquisitions.

> I think the data-driven or evidence-based decision-making process has grown over the last 3 or 4 years I have seen it. It is even getting bigger because it has a huge impact on the processes that we have. It is real data. Data does not lie. (Clive)
>
> Having had a math background, yes data is important, but I think we have to remember the people and the circumstances because data does not always tell you everything. (Daniel)

While data exercises were being used to drive both organizational efficiency and student achievement in some districts, most of the reported challenges stemmed from the organizations' academic staff rather than IT staff. For example, while Megan had great

success working with her IT staff on data-driven exercises on the business side, her academic colleagues struggled to use evidence to support their recommendation decisions.

As mentioned previously, with curriculum departments relying largely on informal research to guide their recommendations, acquisition decisions are suffering. This sentiment is echoed by Digital Promise & Education Industry Association (2014). In their study of educational technology purchasing in the U.S. they stated, "The bad news? With a growing number of products and limited trusted information about them, many districts rely on informal sources instead of data and evidence to make decisions . . . . Further, companies perceive little incentive to produce rigorous evidence" (p. 8). In order for educational technology to be used in support of student learning and not in tokenistic ways, senior leaders need to leverage the collection, analysis, and use of relevant data in their school systems. None of the participants were able to express an explicit vision for how data were being used in conjunction with the technology and their teaching staff in their districts (Mandinach & Honey, 2008). The findings indicated that the participating districts deviate from the literature in that they lack the overall capacity (i.e., skilled analysts, funding, etc.) to ensure their organizations use data that are timely and accessible to inform technology decisions.

Assessment Measures and Return on Investment

Discussion in this section outlines the assessment measures school districts use to decide on the effectiveness of a technology and its impact on student learning that were presented in Chapter Four. Data analysis revealed that school boards had more success conducting technical assessments on hardware/software than academic assessments of the

technology's impact in the classroom (where they had great difficulty). Furthermore, when asked how they reported the return on technology investments or "ROI" within their district, none had a formal process in place to justify their spending.

Assessment measures. The reviewed literature indicates that although large school districts have the capability to run formal "pilot studies" (that assess the technology's impact on instruction and learning before a larger purchase is made) alongside their technology implementations, most struggle to run these effectively (Digital Promise & Education Industry Association, 2014; Morrison et al., 2014). The finding that participants cited numerous challenges with creating useful academic *assessment measures* is aligned with the scholarship. Digital Promise & Education Industry Association (2014) discovered that

> in the absence of trusted evidence of product success, it appears districts rely heavily on peer recommendations and "pilots" within the district. And, based on interviews, those pilots are often informal, essentially "tryouts." Districts do not report using structured, data-driven approaches with clear and inclusive decision-making processes within pilots. Respondents view guidelines for conducting rigorous pilots that are not burdensome for teachers as helpful (p. 14).

Amanda confirmed that many of the pilots conducted in her board were *soft* and largely anecdotal in nature.

> We have done those smaller pilot projects but that is more on the functionality of something. So we are not really looking at the academic impact, we are more looking at the functionality. (Amanda)

It is important to note that in the absence of effective academic assessment measures and organized pilots, some districts are using EQAO scores when making technology-related decisions (i.e., device deployment, staffing, budget allocation, etc.). This practice directly contradicts the reviewed literature that stresses standardized tests measure only fact recall and broad knowledge in students and are largely unrelated to the development/measurement of 21st century skills (Bebell et al., 2010). One senior leader emphasized that although fluctuations in student achievement scores needed to be monitored (and were constantly relayed to stakeholders and trustees), he did not consider them a good measure on which to base decisions (Daniel). With some senior leaders using standardized test results in manners contrary to what is recommended in the scholarship and another questioning its merits in the technology decision-making process, perhaps the role of EQAO test results in Ontario education needs to be revisited.

In light of the challenges associated with the assessment of educational technology being prevalent in all 10 interviews and the boards themselves requesting further guidance from the province of Ontario, perhaps the Ministry of Education should take greater steps in advising districts on how to effectively conduct pilot studies. Morrison et al. (2014) confirms that while large districts value their ability to implement these assessment measures, their frustrations with the process are mounting. They write, "Reliance on evidence of product effectiveness in making product selections is highly valued by nearly all district stakeholders. But there are misunderstandings about what constitutes reasonable evidence in the first place and frustrations in finding credible evidence" (p. 14).

In evaluating the assessment measures used to decide on a technology's effectiveness, districts revealed that they used a combination of both technical and academic measures to inform their decision-making. It should be noted that technical assessments were largely absent from the scholarship on technology procurement. Given that seven senior leaders highlighted the importance of these exercises in the decision-making process (with very few challenges), perhaps further research should be conducted to fully explore its merits.

ROI. The reviewed literature highlights that most senior leaders and their school districts struggle with creating accurate *ROI* measures to justify their technology spending (Krueger, 2013; Maas & Lake, 2015). The finding that participating school districts had no formal ROI process in place is consistent with very recent research on technology acquisition.

> How do you quantify it right? . . . So as we have said there are not a lot of ROI tools. And again, the director of education said . . . . "How do I know that technology is improving instruction?" How do I know anything is improving instruction? Whether it is improved lighting, air conditioning . . . . (Nicholas)

Most senior leaders just reported back to the board of trustees on what they spent in relation to the year's budget and whether student achievement rates had fluctuated. After analyzing the procurement practices of six large urban school districts in the U.S., Maas and Lake (2015) confirmed this finding and stated, "None are using rigorous research and development processes or conducting in-depth return on investment analyses that include student outcomes" (p. 5). With validated ROI calculations (specific to education and educational technology) not being prevalent in the scholarship, Krueger (2013) advocates

for a redefinition of return on investment that focuses less on cost-related factors and more on student learning and community-building (i.e., developing 21st century skills, engaging parents, etc.). He writes,

> But the mission of schools is not to increase revenues but rather to use public monies wisely in producing students who are thoughtful, productive citizens and members of the workforce. That is how schools "create value" for their communities. So, even though most aspects of schools' performance cannot be measured in financial terms, there are still measurable ways that you can demonstrate to stakeholders the value of the investment in technology in terms of advancing the educational mission of the district. (Krueger, 2013, p. 26)

Consequently, this study reinforces the notion that in the absence of traditional ROI calculations for technology spending, districts need to shift their focus to analyzing technology's impact on student learning.

Implications

In this section possible application of the study's findings for practice and future research are considered. In order to increase the success of their technology implementations, senior leaders need to ensure that the procurement practices in their districts are grounded in best practices and aligned with the relevant research. The Research Validated Framework of Technology Decision-Making (Figure 4) is both aligned with the study's conceptual framework and is used as a basic expectation of senior leaders who are making technology decisions at the district level. In addition, areas for further research are proposed. Particular attention is paid to some of the challenges

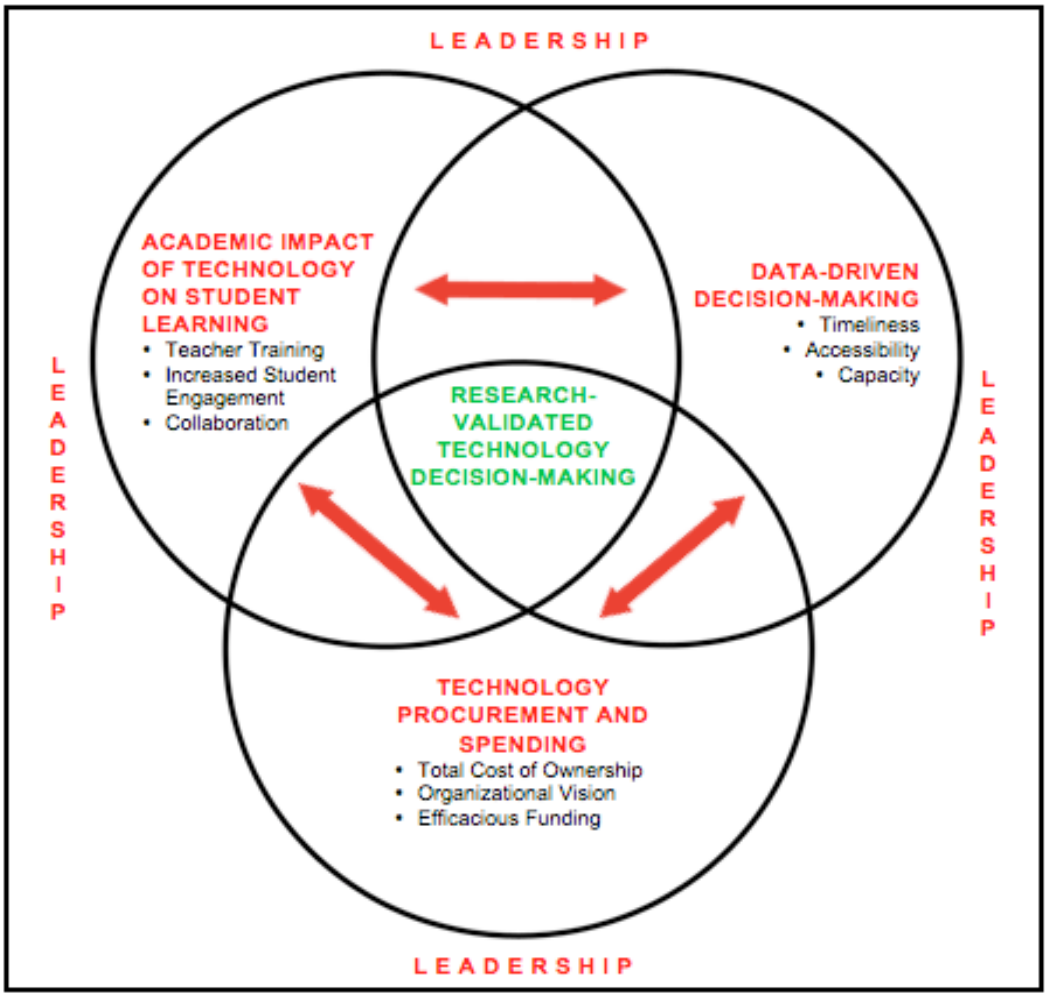

Figure 4. Research validated framework of technology decision-making.
Note. Reproduced figure from Chapter Two.

districts encountered during the purchase, implementation, and evaluation of education technology.

Implications for Practice

This research demonstrated that when compared and contrasted against the study's Research Validated Framework of Technology Decision-Making (Figure 4), senior leaders are not making decisions that are aligned with formal research, grounded in best practices, and in enhancement of student learning. This conceptual framework represents the best thinking about technology acquisition in school districts and has been developed in part by reviewing the relevant literature.

In the area of *technology procurement and spending*, senior leaders placed great emphasis on the total cost of ownership and efficacious funding associated with the acquisition of a new technology. However, only half made reference to the existence of an organizational vision that was being used to guide current/future technology spending. When examining the *academic impact of technology on student learning*, senior leaders placed little emphasis on the three essential conditions during acquisition. In most cases, student engagement was assessed only after the technology had already been purchased. Only two senior leaders referenced collaboration and teacher training in their interview responses. Finally in the area of *data-driven decision-making*, most senior leaders stated that their district lacks the overall capacity to ensure that data are both timely and accessible for decision-makers. With stark similarity to the acquisition practices of school districts in the United States (that also report numerous challenges), Ontario school boards need to be more *strategic* with their purchasing in order to further differentiate themselves in the procurement of technology.

In amassing the various conditions present in the literature related to the technology decision-making process, a unique comparison emerged. *Tic-tac-toe* is a commonly played game dating back to the Roman Empire, in which two players, X and O, try to place three particular marks in a row (horizontal, vertical, diagonal) on a 3x3 grid before the other can (Zaslavsky, 1982). What is often overlooked is that there is a distinct strategy to this game that increases one's ability to win based on the previously made move (rooted in statistical probability). However, more often than not the strategy is ignored and the game often ends in a draw with neither side prevailing.

Typically used as a pedagogical tool, the game of tic-tac-toe also has distinct applications to educational technology decision-making. The literature and findings have shown us that districts lack guidance when purchasing technology and often act impulsively when spending taxpayer dollars. The same can be said for all those tic-tac-toe games that end in a draw. Too often a player chooses the square with no regard for the strategy and simply settles for marking an open space that seems logical at the time. However, using relevant scholarship as one's *strategy* during technology decision-making can help districts avoid missed opportunities and costly mistakes. The Strategic Model for Technology Acquisition (Figure 5) gives districts the opportunity to ensure that each decision they make in relation to the academic impact of technology on student learning, data-driven decision-making, and technology procurement and spending is aligned with the key theories and body of research. For the purposes of this framework the areas were renamed strategic academic assessment (*TIC*), strategic data use *(TAC*), and strategic acquisition (*TOE*).

A common grievance with large size school districts is the extensive bureaucratic

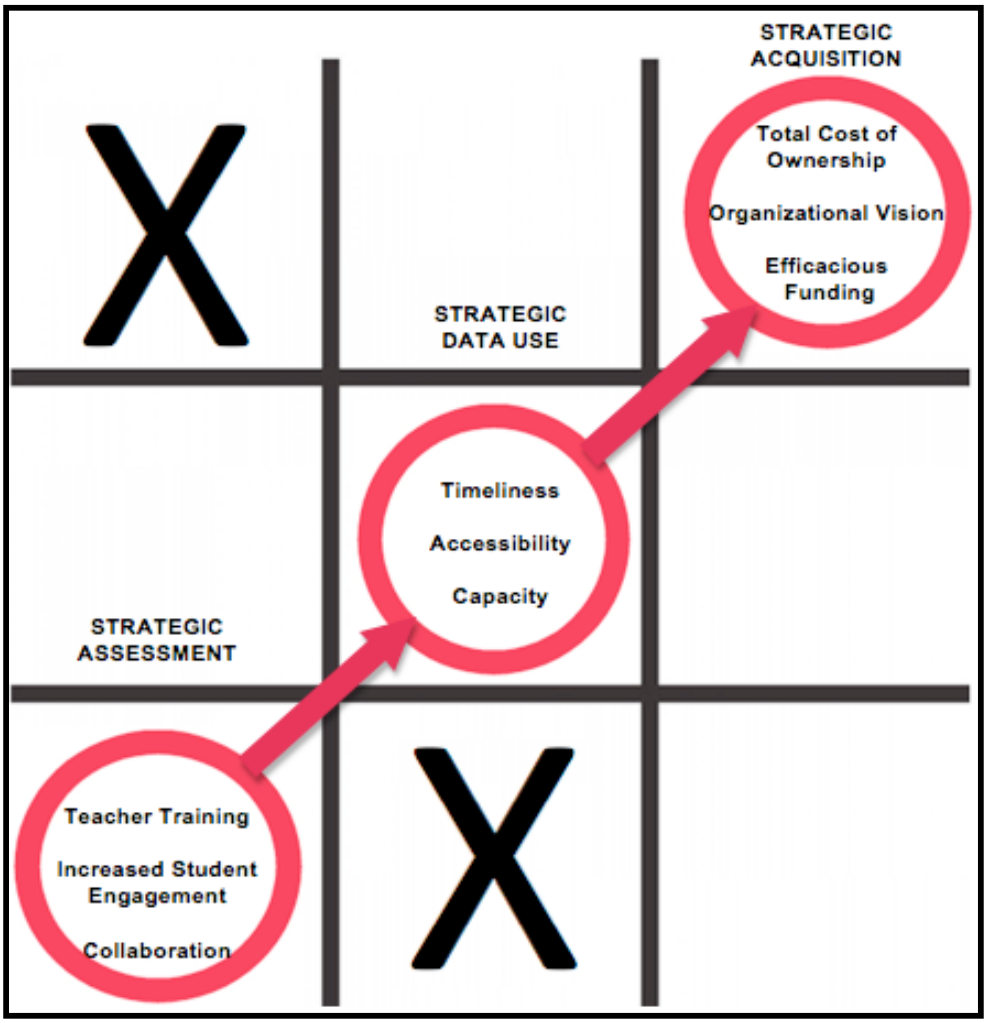

Figure 5. Strategic model for technology acquisition.

structures and policies in place to deal with just *one* of the areas of the study's conceptual framework. The use of a framework that encompasses student learning, data, and good purchasing habits (as they relate to technology) may help refine decision-making in publicly funded school districts. The Strategic Model for Technology Acquisition (Figure 5) reinforces the expectation that senior leaders focus their attention (and public dollars) towards best practices that are rooted in improving student learning and are fiscally responsible.

Implications for Further Research

This collective case study revealed a number of interesting findings, including the fact that current educational technology procurement practices in the 10 participating school districts are not aligned with the relevant scholarship. With the prevalence of ICT in K–12 schooling rapidly increasing (through blended learning environments, 1:1 computing, 3D printing, etc.), the amount of quality research that explores best practices in procurement must also increase.

Future research should consider studying both centralized and decentralized procurement strategies and their respective advantages/disadvantages in small, medium, and large size school districts. While very recent research has uncovered information about technology purchasing, governance, and assessment in different size school districts (Digital Promise & Education Industry Association, 2014; Maas & Lake, 2015; Morrison et al., 2014), more comprehensive work needs to be done in this area. With larger school districts in particular struggling with technology acquisition, researchers need to intervene before costly mistakes begin to have a negative impact on student learning.

With the acquisition process shifting in K–12 education, the Strategic Model for Technology Acquisition (Figure 5) should be updated as more research begins to emerge. Today, very little formal scholarship exists on educational technology procurement (specifically), and the model should be adjusted if innovations in technology alter the overall focus/mandate of publicly funded school districts and student learning.

Several interview participants stated that they are struggling to conduct pilot studies that have extractable data that can be used to inform decision-making and assess student learning through technology (most senior leaders sift through large amounts of anecdotal data). These statements should be researched further to discover how technologies are piloted in different districts and whether this process can be improved to refine decision-making (i.e., if pilots are conducted with measurable outcomes, districts can use the results to avoid unnecessary purchases).

While the results of this case study produced similar results to the recent studies conducted on educational technology procurement in school districts in the United States, the Canadian context should be further explored. Little research has been discovered on educational technology acquisition in Canada, and this study should be accompanied by investigations into other related areas. One cannot assume similarities between the U.S. and Canadian education systems based on the results of this research study.

Finally, researchers may wish to examine the lack of stakeholder knowledge about technology acquisition and implementation. Five participants in this study stated their districts encountered several challenges due to the fact that most parents, teachers, students, and so on do not understand the procurement process and/or role of technology in the learning environment. Clive spoke at length about common misconceptions about

his department and their role in balancing both innovation and security in the district. With some parent councils clamoring for their children to have access to iPads (at all costs), Clive struggled to help them understand that it was not that simple.

> For the schools the biggest thing is . . . what works for an individual does not work for an enterprise. The technology that works in a home space does not succeed in an enterprise space. The challenges are huge. Again for your work's understanding, the iPad is a single profile device. I cannot have kids sharing iPads because the work is not going to be protected. Simple things. It is a very nice tool. Works well. If every student is to have their own device in their hands, it is a very powerful tool. But when it comes to protecting the data and privacy of the data and privacy of the work, I cannot provide that on that device because it is not engineered to do that. It is not designed that way . . . . So just having a clear understanding about personal space and the business space is a huge challenge to make the schools understand that. That is one big barrier. (Clive)

Limitations of the Study

Embedded in the implications for further research are some of the limitations of this study. Among the limitations of this research is the limited scope and number of participating districts. While the 10 participants represent the technology leadership for approximately 746,000 Ontario students (37% of the province's student population), including more districts could possibly increase the generalizability of the results. This study did not interview other educational stakeholders (e.g., teachers, students, parents, IT staff, etc.) to gauge their impressions of the educational technology procurement process in their respective districts. Additionally, this study did not obtain school board

invoices to determine if the senior leaders' responses reflected their real-world purchasing behaviours. School board policy documents were reviewed but only to provide contextual information for the researcher during analysis of the transcript data.

Conclusions

Given the substantial rise in technology expenditures by publicly funded school boards throughout Ontario, a deeper inquiry into the technology procurement process was vital to ensure senior leaders are being fiscally responsible and acquiring technologies that positively impact student learning. An examination of current literature surrounding technology acquisition in K–12 school districts indicated that there was a significant gap in the research. With technology spending increasing and still very little known information about the K–12 educational technology decision-making process in Canada, there was a need for a qualitative study that collected data from participants who occupy senior-level leadership positions (i.e., CIOs, superintendents, etc.).

Accordingly, the main purpose of this study was to determine if the technology procurement process in Ontario's publicly funded school districts is informed by the relevant research, grounded in best practices, and enhances student learning. Specifically, the study aimed to examine the procurement, governance, assessment, and return on investment (ROI) measures utilized by school districts in their implementation of educational technology. The main research questions that guided the study were therefore:

- How do Ontario's publicly funded school districts make decisions on acquiring new technology for their school systems?

- What are the most important factors senior leaders consider when procuring educational technology? Is this supported by relevant research?
- What are the governance procedures for technology procurement and spending? Is this guided/supported by data-driven decision-making?
- What kinds of assessment measures are in place to decide on the effectiveness of a technology and its impact on student learning? How do school districts measure and report on the return on this type of investment?

This study appears to be the first of its kind in Canada that calls upon the viewpoints of senior-level leaders, and their contributions represent the decision-making processes behind educational technology acquisition for approximately 746,000 Ontario students. The 22 interview questions were developed based on the existing literature and the study's conceptual framework (which were rooted in the main research questions). Ten senior leaders (each from different publicly funded school districts in Ontario) participated in a single 60-to-90 minute semistructured interview. Once all of the interview data had been collected, "Computer-assisted NCT analysis" (Friese, 2014) using ATLAS.ti was conducted.

Analysis of the data found that the most important factors senior leaders consider when procuring educational technology are not aligned with the reviewed literature and the study's Research Validated Framework of Technology Decision-Making (Figure 4). Cost and infrastructure-related factors were highly prevalent in the interview data and greatly outweighed their consideration of technology's impact on instruction and student learning. Policy, committees, and senior district leadership were identified as being key components in the governance of educational technology spending. However, these

procedures were found to be unsupported by relevant data. Similar challenges were discussed in relation to the assessment measures used to determine a technology's effectiveness and in reporting a return on their investments (ROI) to stakeholders.

While it may seem that districts are encountering numerous challenges in several key areas of educational technology procurement, there is one area in which they excel: purchasing. The findings revealed that senior leaders are very aware of the financial implications of introducing a new technological product into their organization and that it is in fact the *most* important consideration they make during the acquisition process. From durability to sustainability, affordability to cost-saving, district leaders are going above and beyond to ensure they are not being swindled by vendors and complying with provincial guidelines. It is no surprise that these leaders are so adept at purchasing as the entire process is tightly contained by the *Broader Public Sector (BPS) Procurement Directive* (which is standard practice for all public sector organizations in Ontario). With the perils of excessive technology spending becoming increasingly frequent, districts are going to extreme lengths to ensure they do not get burned. So what is the problem?

The issue lies with the fact that school leaders have become so focused on not being seduced by the shiny allure of classroom technology that they are ignoring/undervaluing the pedagogy and the product's impact on student learning. This is misguided and highly dangerous when you consider the price districts like Los Angeles Unified have had to pay for taking the same approach (i.e., poor usage rates, lack of teacher support, scrapped rollout, etc.). While this may seem like an extreme scenario when compared to Ontario's publicly funded school districts, the stakes are just as high. With over 2,000,000 students enrolled in the province, it cannot afford to fail.

In order to right the ship, senior leaders need to ensure their primary focus is on improving student learning. Fullan's (2013b) advocacy for "motion leadership" is well suited here, as this shift in approach will have repercussions throughout entire school districts. He writes, "Motion leadership is about leadership that causes positive movement forward for individuals, organizations, and entire systems" (Fullan, 2013b, p. 66). Utilizing the elements of pedagogy, technology, and change knowledge (i.e., the *Stratosphere*) in concert, may provide our educational system with the focused discipline it needs. This shift will need to be accompanied by numerous changes (all of which need to be grounded in research). For example, the findings (and reviewed literature) revealed that teachers have a limited role in the acquisition process and are mostly relied upon to help implement the technology throughout their schools and classrooms. By this point the wrong product might have already been purchased instead of a technology teachers prefer to use. Additionally, the lack of objective research being conducted after a technology has been implemented is troubling (i.e., informal pilot studies). Senior leaders need reliable data to inform their decision-making and can no longer base large purchases based on anecdotal (or in some cases nonexistent) reports. Finally, while the rise of ICT has disrupted the roles and responsibilities of both technical (IT) and academic (curriculum) departments, both groups need to work together to support 21st century learning for students.

Resolving the challenges associated with technology acquisition is only one of the many steps needed to be taken in order to implement meaningful education reform in Ontario. The rapid pace at which technology is advancing is certainly not helping our case. Yet while we are right in our reluctance to chase technology for our school systems,

we should instead be sprinting towards establishing best practices, fostering innovation, and leveraging personalized learning opportunities for our students. After 15 years in the 21st century we have been sluggish in that regard. However, with progressive leadership that places student learning at the helm, we can create an education system so rich in pedagogy and focused discipline that we may be able to catch up after all.

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Appendix A

Interview Questions

- Describe your current role, duties, and responsibilities as a senior leader at a publicly funded school board in Ontario. Do you make decisions regarding technology acquisition?

- How does your school district make decisions on purchasing new technology for your school system? What factors would you say are most important in making these decisions? (Please rank from most important to least important.)

- Compared to some of the other factors related to technology acquisition, where would you rank the price of the technology in terms of its influence on your acquisition of it?

- Is the acquisition process in your school district formal or informal? Do you have a written protocol? If so, can I have a copy?

- Are you more prone to wanting to acquire cheap or free technology/technological tools?

- What do you think a school leader should be cautious of in using or accepting free technological tools (hardware, software, etc.)?

- How, if at all, do you negotiate the dilemma between accepting free technological resources for your system/school and protecting this school/system from "soft" corporate incursions into learning spaces?

- What social issues are most important to you in considering technology acquisition?

- Did you discover any new technological resources at the 2014 CONNECT Conference that you are interested in implementing in your school district?

- By way of example, can you take me step by step through the complete decision-making process involved in the recent acquisition of a new technology, from the genesis of the idea right through to its purchase and implementation? Is there a specific person or committee that determines if a product should be acquired? Who then needs to be consulted for the purchase of a product to become actionable?

- Precisely which educational stakeholders are involved in acquisition ideas, and at what stages of decision making? (Or, at what stages are various educational stakeholders consulted/informed about the acquisition?)

- What is the precise governance structure with respect to how decisions are made?

- How did you decide you wanted this technology? What sources did you specifically seek to decide that this was a worthwhile technology?

- Did you consult any empirical research about said technology and its benefits? Do you draw on empirical data to decide on things like the “shelf life" of the technology? The contemporary relevancy of the technology? Repair or update costs? The ease or difficulty of teacher training regarding uses of the technology?

- What kind of assessment measures do you have in place to decide on the effectiveness of a new technology once acquired? Are there specific measures to assess the *academic* impact?

- What role, if any, do standardized test results have in the acquiring of educational technology? What about in the evaluation of the effectiveness of a technology?

- Can you give some examples of recent acquisition assessments you've done and what you learned from the process?

- How do you report the return on investment (ROI) of technology spending within your school district?

- Does your school district employ the use data-driven decision-making (DDDM, i.e., the ability, through the use of technology, to gain precise information/data about a range of learning and learner behaviours)? If yes, can I have an example or general idea of how this is being used within your board? What types of data are you using?

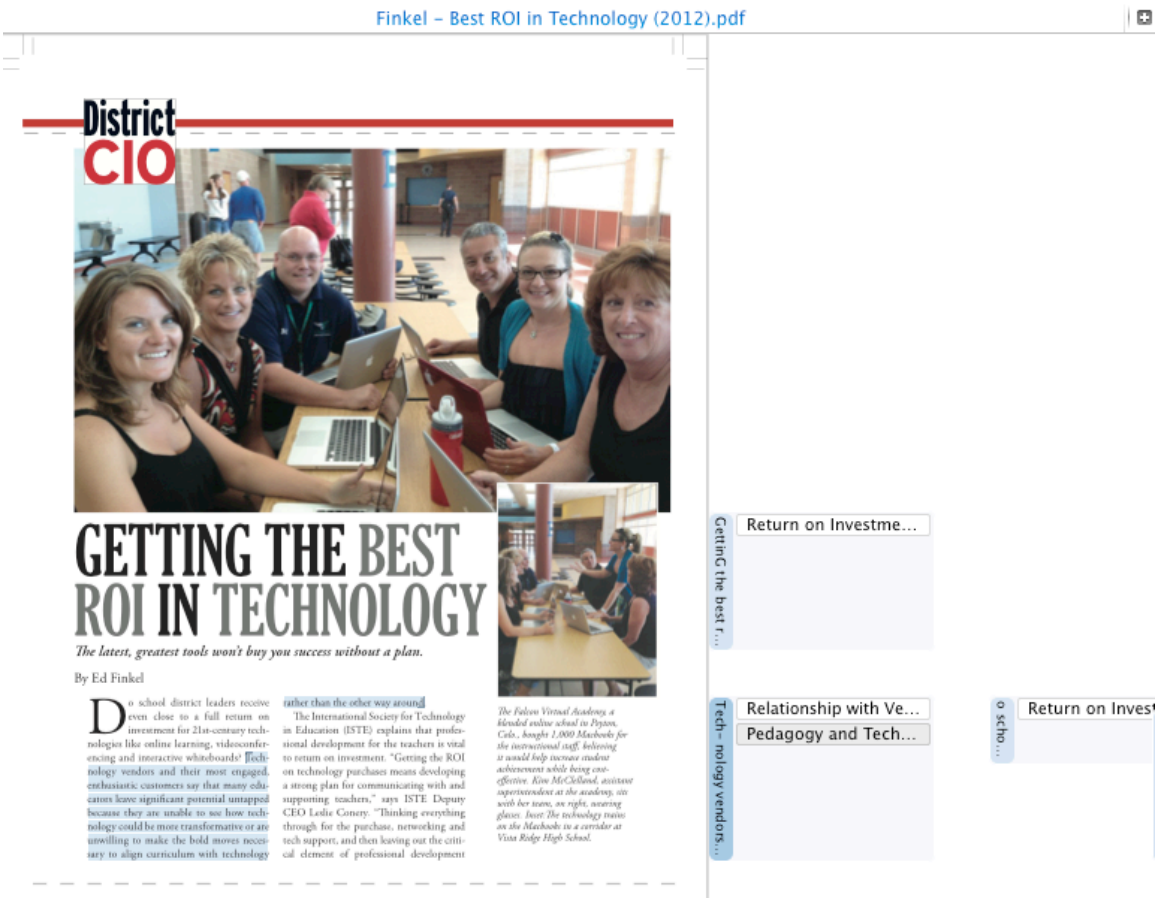
- Do you feel DDDM has positive benefits for learners? What are some of its strengths and weaknesses?

- How has the technological acquisition landscape changed over the course of your career as a school leader?

- Are there certain changes you can highlight that you feel others would be interested in knowing about?

Appendix B

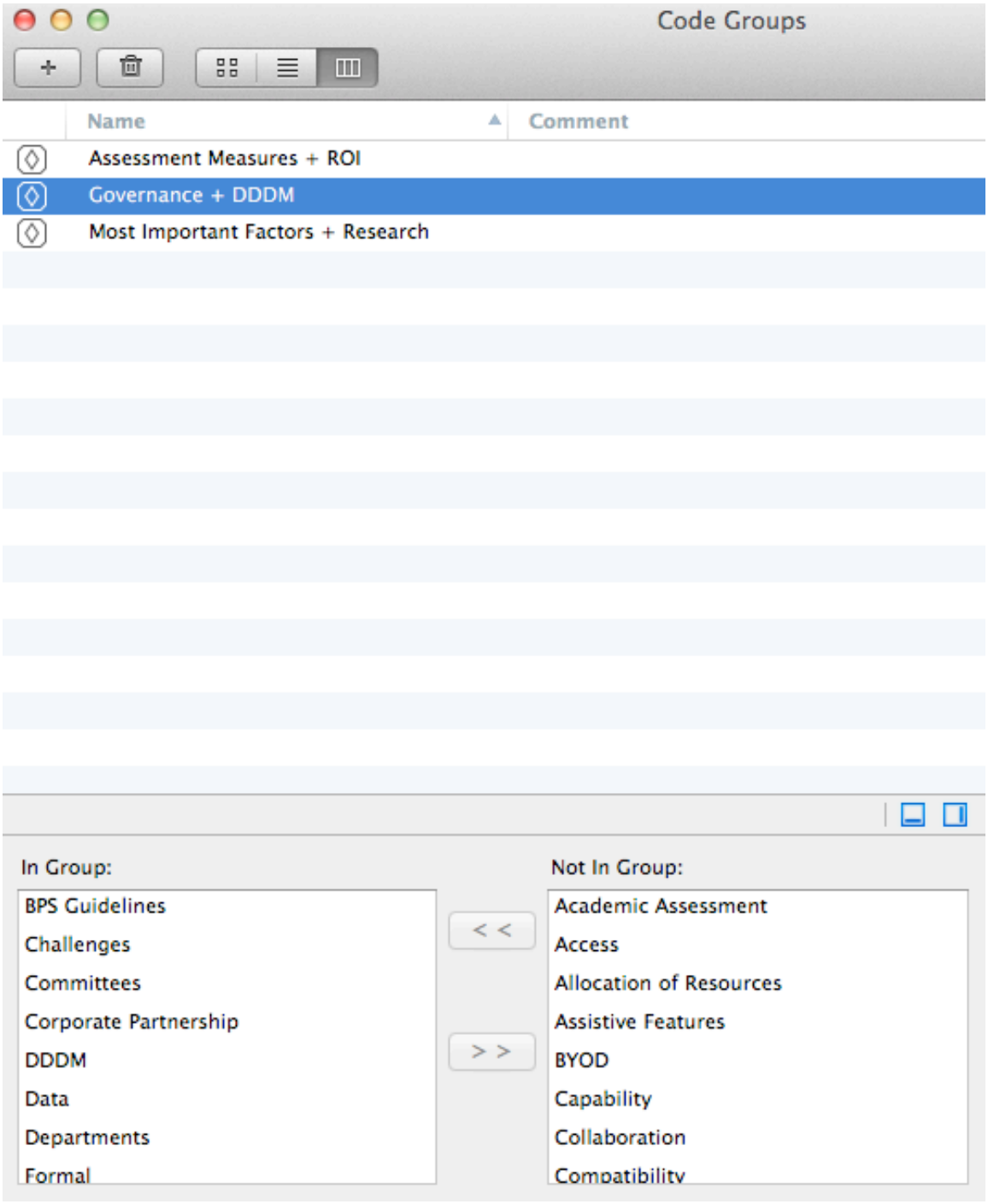
Phase One of the NCT Method (*Noticing*)



Note. All materials related to the study were uploaded to ATLAS.ti and preliminary codes were attached to relevant quotations in the text.

Appendix C

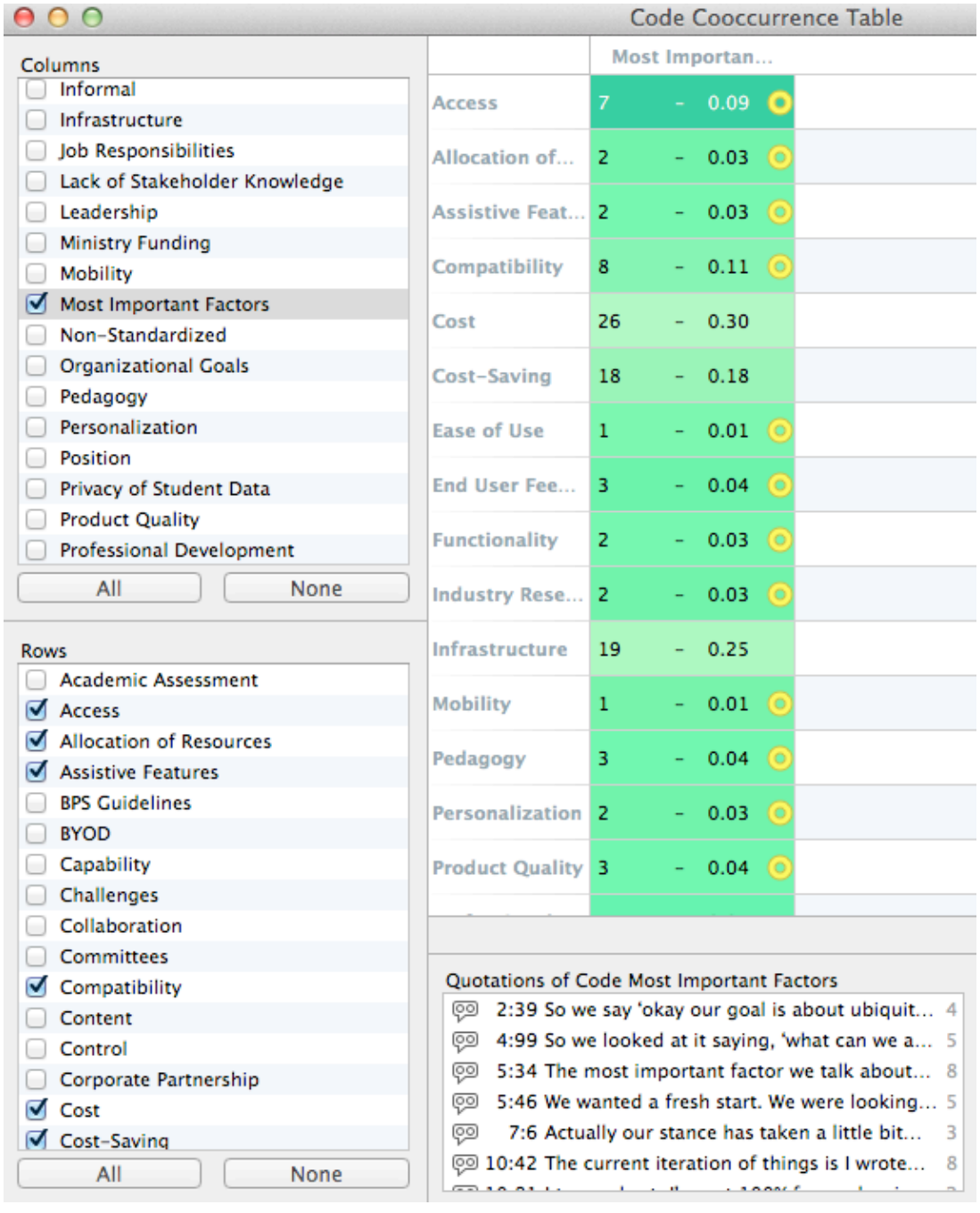
Phase Two of the NCT Method (*Collecting*)



Note. Similar items were then collected under existing, new, or merged code labels and subsequently organized according to the research questions (using the *Code Group Manager*).

Appendix D

Phase Three of the NCT Method (*Thinking*)



Note. Tools like the *Code Cooccurrence Table* allowed the researcher to discover patterns across the cases and gauge what themes/responses were most frequent in the interview transcripts.